BELL TELEPHONE QUARTERLY

VOL. XIV OCTOBER, 1935

MODERN BUSINESS ADOPTS THE TELETYPEWRITER

ANSWERING STOCKHOLDERS' LETTERS BY TELEPHONE

TWENTY YEARS OF TRANSCONTINENTAL SERVICE

THE CHANGING YEARS AS SEEN FROM THE SWITCHBOARD

CHANGES IN BIRTH AND DEATH RATES AS AFFECTING POPULATION GROWTH

AMERICAN TELEPHONE & TELEGRAPH CO. • NEW

BELL TELEPHONE QUARTERLY

A Medium of Suggestion and a Record of Progress

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Address all communications to

INFORMATION DEPARTMENT
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
195 Broadway, New York

Contributors to this Issue

J. M. TUGGEY, JR.

Lehigh University, B.A., 1924. National Lead Company, Advertising Department, 1924–25. American Telephone and Telegraph Company, Long Lines Department, assistant to Supervisor of Telephotographs, 1925–26; Special Contract Service Sales Section, 1926–27; Telephotograph Representative, 1927–28; Publicity Department, Advertising Assistant, 1929–33; Sales Promotion Supervisor, 1933–.

J. K. TORBERT

University of Texas, B.A., 1912; Harvard University, M.A., 1916. Massachusetts Institute of Technology, Instructor in English, 1916–17. World War Service, 1917–19. E. P. Dutton & Company, editorial work, 1919–21. American Telephone and Telegraph Company, Treasury Department, 1921–.

J. J. PILLIOD

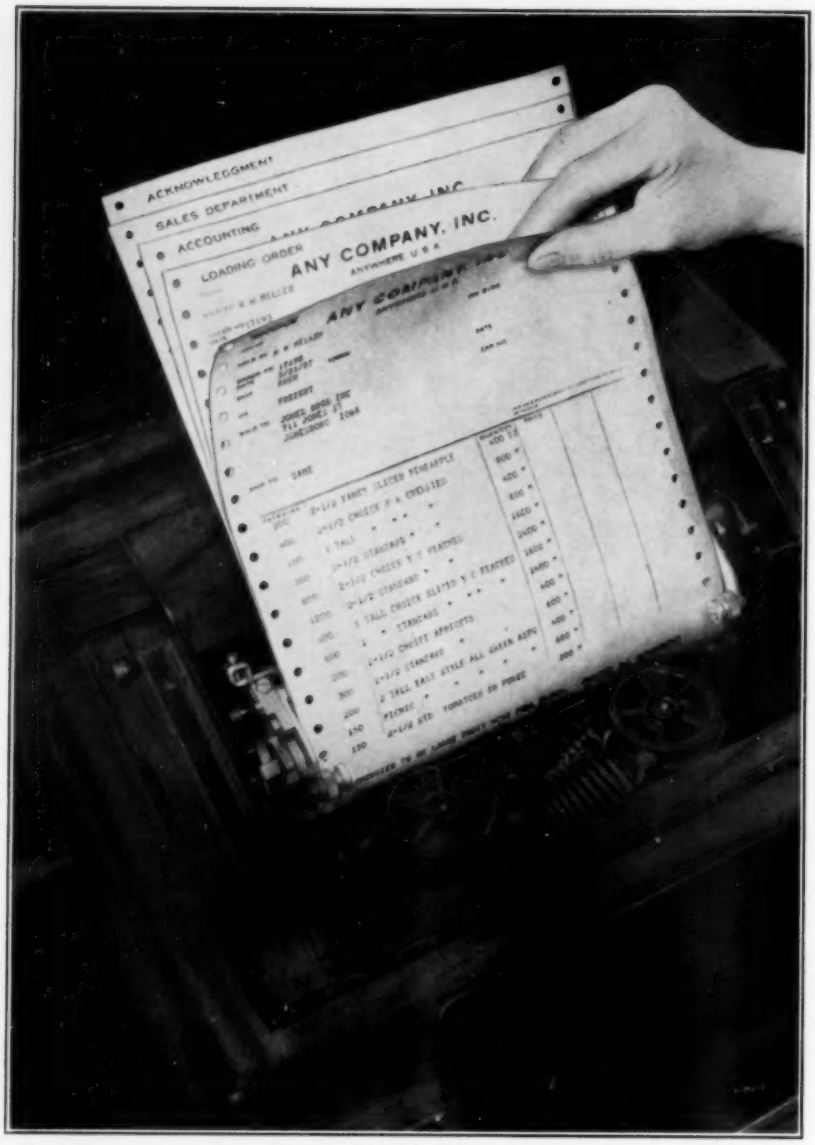
Ohio Northern University, E.E., 1908. American Telephone and Telegraph Company, Long Lines Department, 1908–11; General Engineering Department, 1912–13; Long Lines Department, Division Plant Engineer, 1914–17, Engineer of Transmission, 1918–19, Engineer, 1920–.

R. T. BARRETT

Lafayette College, B.A., 1907; New York Law School, LL.B., 1909. Engaged in practice of law, 1909–18, and in newspaper work until 1921, when he entered the Information Department, American Telephone and Telegraph Company. Mr. Barrett has contributed occasional articles to the BELL TELEPHONE QUARTERLY.

R. L. TOMBLEN

Bates College, B.A., 1914; Worcester Polytechnic Institute, B.S., 1917. American Telephone and Telegraph Company, Department of Operation and Engineering, Commercial Engineer's Division, 1919–29; Chief Statistician's organization, 1929–.



THE SIMULTANEOUS PRODUCTION OF MULTIPLE COPIES OF BUSINESS FORMS ON TWO OR MORE CONNECTED TELETYPEWRITERS, NO MATTER HOW FAR APART, IS A USEFUL FEATURE OF BELL SYSTEM TELETYPEWRITER SERVICE. HOW THIS INSTANTANEOUS "FORM WRITING" AT A DISTANCE AIDS MODERN BUSINESS IS TOLD IN THE ARTICLE WHICH BEGINS ON THE OPPOSITE PAGE.

Modern Business Adopts the Teletypewriter

AT the beginning of the year 1935, there were throughout the country more than 12,000 teletypewriters connected to the Bell System. The widespread adoption by industry of the "typing by wire" method of communication is proof of its value to modern American business. Instantaneous two-way communication and a printed record of every transaction are fundamental advantages which the service has always offered and which have been generally recognized for a long time.

In the last half century economic necessity has dictated the geographical separation of industrial units. If national markets are to be reached and production costs held within reasonable limits, there must be sales representation at distribution centers and factories close to raw materials. Moreover, the activities of these units have to be closely coördinated. Long before the advent of the teletypewriter, industry was exercising control over distant offices principally by mail, message telephone and telegraph services and by private wires, either telephone or Morse.

It was natural, therefore, that the exclusive advantages of teletypewriter service should cause it to be adopted for similar purposes by many industrial companies soon after it was offered commercially. At that time the service was available only on a private line basis and was used generally by the larger concerns.

In recent years, however, the scope of teletypewriter service has been so broadened that it is now within the reach of practically any company. In addition, it has been successfully applied to fundamental business practices in ways which were not dreamed of a few years ago. All this has been made pos-

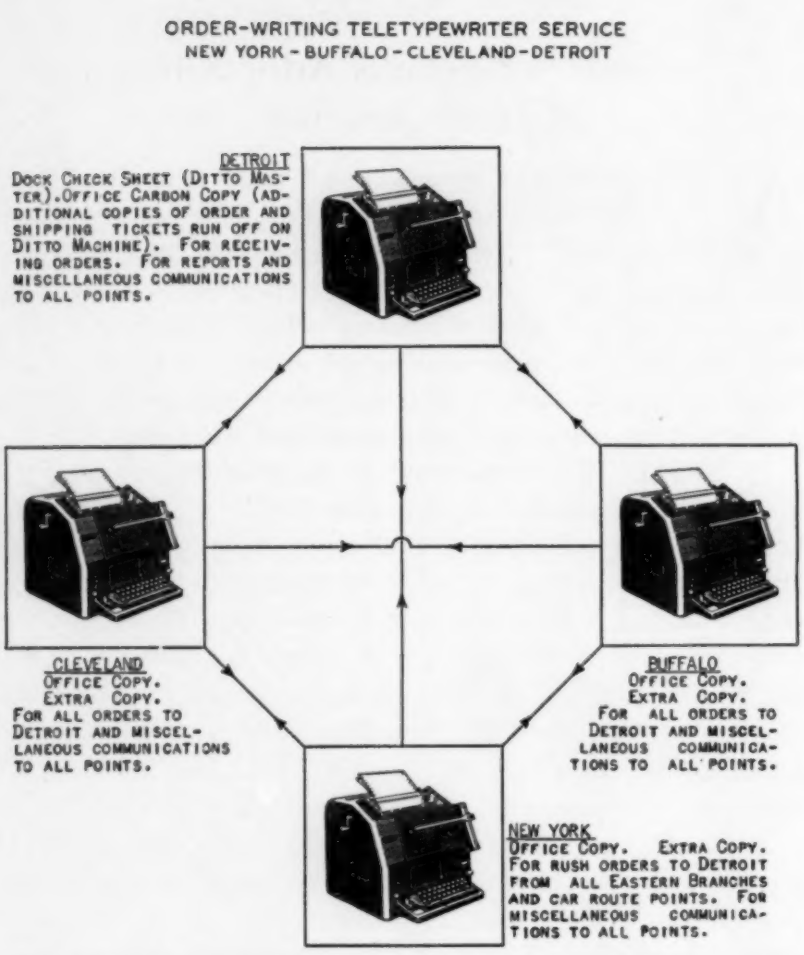

ORDER-WRITING TELETYPEWRITER SERVICE
NEW YORK - BUFFALO - CLEVELAND - DETROIT
DETROIT
DOCK CHECK SHEET (DITTO MASTER). OFFICE CARBON COPY (ADDITIONAL COPIES OF ORDER AND SHIPPING TICKETS RUN OFF ON DITTO MACHINE). FOR RECEIVING ORDERS. FOR REPORTS AND MISCELLANEOUS COMMUNICATIONS TO ALL POINTS.
CLEVELAND
OFFICE COPY.
EXTRA COPY.
FOR ALL ORDERS TO DETROIT AND MISCELLANEOUS COMMUNICATIONS TO ALL POINTS.
BUFFALO
OFFICE COPY.
EXTRA COPY.
FOR ALL ORDERS TO DETROIT AND MISCELLANEOUS COMMUNICATIONS TO ALL POINTS.
NEW YORK
OFFICE COPY. EXTRA COPY.
FOR RUSH ORDERS TO DETROIT FROM ALL EASTERN BRANCHES AND CAR ROUTE POINTS. FOR MISCELLANEOUS COMMUNICATIONS TO ALL POINTS.

FIG. 1. THIS DIAGRAM REPRESENTS A PRIVATE-LINE TELETYPEWRITER ORDER-WRITING SYSTEM WHICH PERMITS A REVISION OF FORMER ORDER-WRITING METHODS, IMPROVES SERVICE TO CUSTOMERS, AND ENABLES THE COMPANY ADOPTING IT TO COMPETE WITH OTHER COMPANIES IN EASTERN MARKETS ON AN EQUAL BASIS. FIGURES 2, 3 AND 4 ILLUSTRATE GRAPHICALLY THE IMPROVEMENTS IN THE TECHNIQUE OF HANDLING ORDERS AND THE ELIMINATION OF STEPS PREVIOUSLY REQUIRED TO HANDLE THE SAME WORK, AT A SAVING OF TIME AND COST.

CHANGES IN ORDER ROUTINE AT DETROIT
ON ORDERS FROM CLEVELAND. BUFFALO
AND ALL EASTERN POINTS

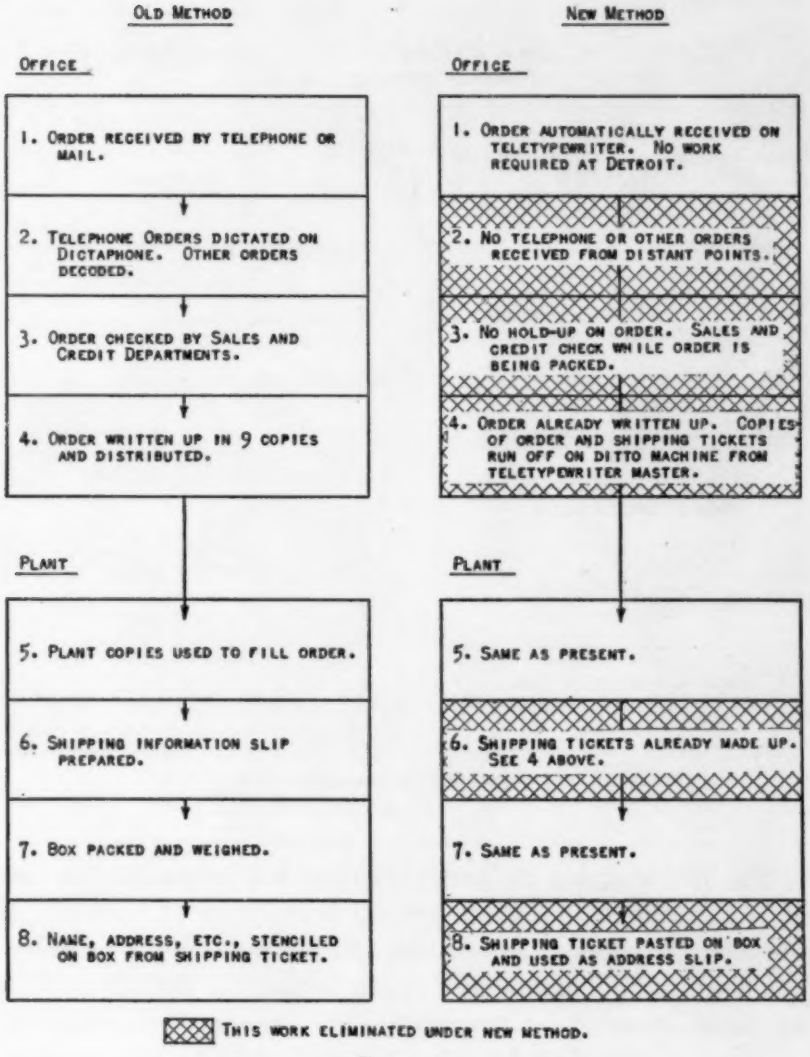

OLD METHOD
NEW METHOD
OFFICE
1. ORDER RECEIVED BY TELEPHONE OR MAIL.
2. TELEPHONE ORDERS DICTATED ON DICTAPHONE. OTHER ORDERS DECODED.
3. ORDER CHECKED BY SALES AND CREDIT DEPARTMENTS.
4. ORDER WRITTEN UP IN 9 COPIES AND DISTRIBUTED.
PLANT
5. PLANT COPIES USED TO FILL ORDER.
6. SHIPPING INFORMATION SLIP PREPARED.
7. BOX PACKED AND WEIGHED.
8. NAME, ADDRESS, ETC., STENCILED ON BOX FROM SHIPPING TICKET.
OFFICE
1. ORDER AUTOMATICALLY RECEIVED ON TELETYPEWRITER. NO WORK REQUIRED AT DETROIT.
2. NO TELEPHONE OR OTHER ORDERS RECEIVED FROM DISTANT POINTS.
3. NO HOLD-UP ON ORDER. SALES AND CREDIT CHECK WHILE ORDER IS BEING PACKED.
4. ORDER ALREADY WRITTEN UP. COPIES OF ORDER AND SHIPPING TICKETS RUN OFF ON DITTO MACHINE FROM TELETYPEWRITER MASTER.
PLANT
5. SAME AS PRESENT.
6. SHIPPING TICKETS ALREADY MADE UP. SEE 4 ABOVE.
7. SAME AS PRESENT.
8. SHIPPING TICKET PASTED ON BOX AND USED AS ADDRESS SLIP.
THIS WORK ELIMINATED UNDER NEW METHOD.

FIGURE 2.

sible by mechanical improvements and the invention of special equipment, the results of continuous laboratory experiment over a long period. Exhaustive investigations of the requirements of business have played an important part in these advances.

CHANGES IN ORDER ROUTINE AT CLEVELAND AND DETROIT ON ORDERS FROM CLEVELAND

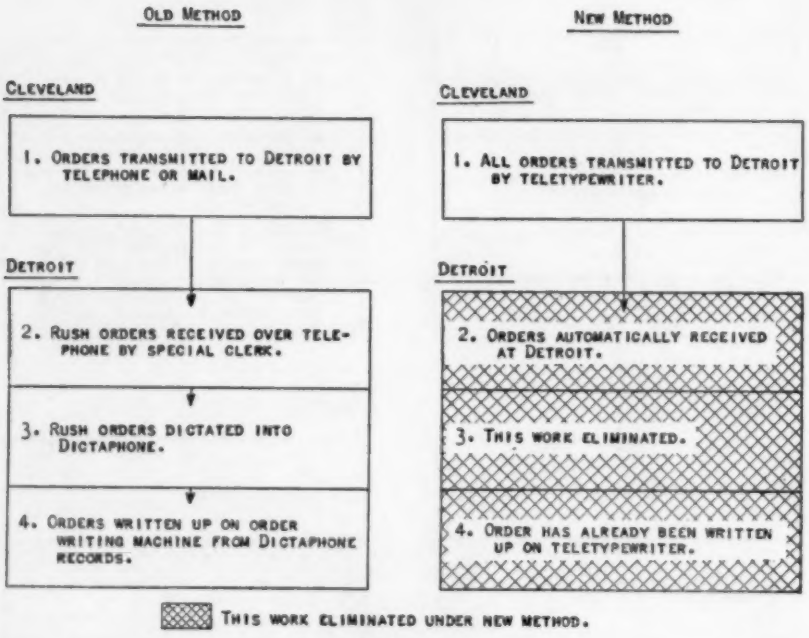

OLD METHOD
CLEVELAND
1. ORDERS TRANSMITTED TO DETROIT BY TELEPHONE OR MAIL.
DETROIT
2. RUSH ORDERS RECEIVED OVER TELEPHONE BY SPECIAL CLERK.
3. RUSH ORDERS DICTATED INTO DICTAPHONE.
4. ORDERS WRITTEN UP ON ORDER WRITING MACHINE FROM DICTAPHONE RECORDS.
NEW METHOD
CLEVELAND
1. ALL ORDERS TRANSMITTED TO DETROIT BY TELETYPEWRITER.
DETROIT
2. ORDERS AUTOMATICALLY RECEIVED AT DETROIT.
3. THIS WORK ELIMINATED.
4. ORDER HAS ALREADY BEEN WRITTEN UP ON TELETYPEWRITER.
THIS WORK ELIMINATED UNDER NEW METHOD.

FIGURE 3.

The introduction of Teletypewriter Exchange Service late in 1931 resulted in a more general acceptance by industry of the teletypewriter as an efficient and business-like communication medium. The new service can be used for periods as short as three minutes. Connections are obtained on demand, whereas private line facilities are furnished by pre-arrangement. Moreover, any subscriber can be connected through

MODERN BUSINESS ADOPTS TELETYPEWRITER

CHANGES IN ROUTINE ON ORDERS FROM BUFFALO

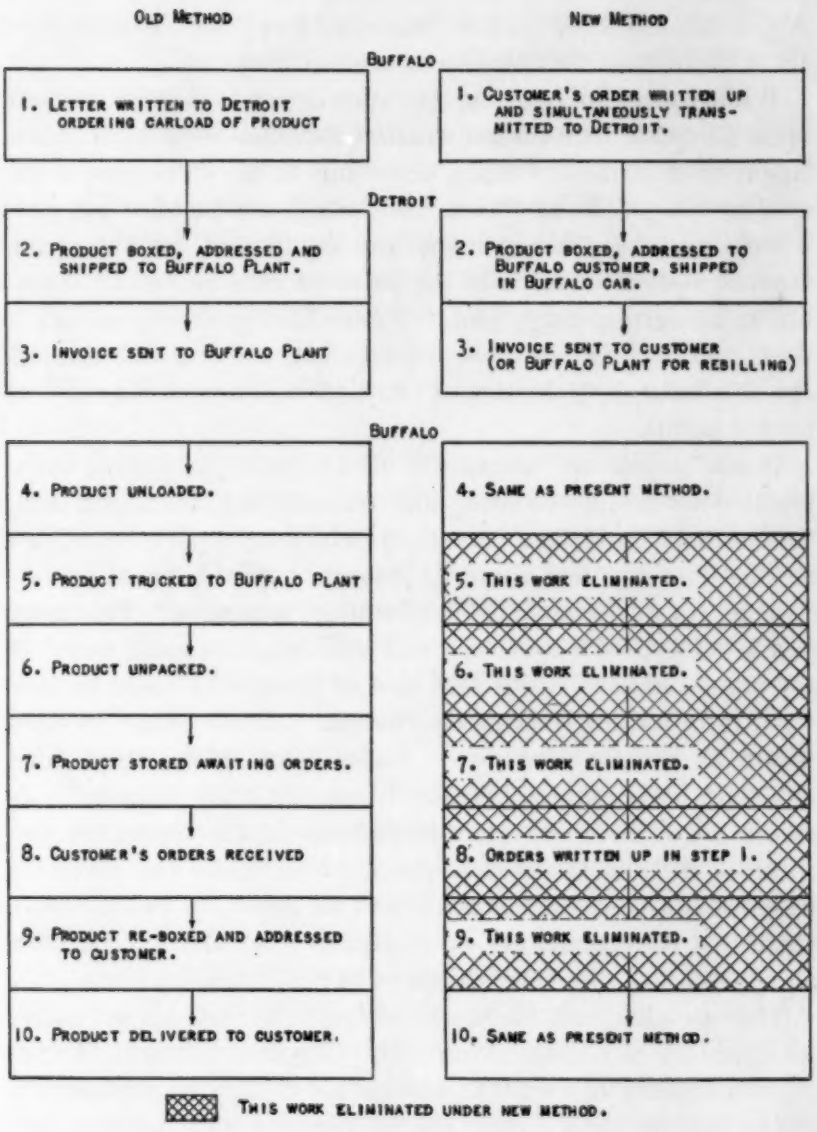

OLD METHOD
NEW METHOD
BUFFALO
1. LETTER WRITTEN TO DETROIT ORDERING CARLOAD OF PRODUCT
1. CUSTOMER'S ORDER WRITTEN UP AND SIMULTANEOUSLY TRANSMITTED TO DETROIT.
DETROIT
2. PRODUCT BOXED, ADDRESSED AND SHIPPED TO BUFFALO PLANT.
2. PRODUCT BOXED, ADDRESSED TO BUFFALO CUSTOMER, SHIPPED IN BUFFALO CAR.
3. INVOICE SENT TO BUFFALO PLANT
3. INVOICE SENT TO CUSTOMER (OR BUFFALO PLANT FOR REBILLING)
BUFFALO
4. PRODUCT UNLOADED.
4. SAME AS PRESENT METHOD.
5. PRODUCT TRUCKED TO BUFFALO PLANT
5. THIS WORK ELIMINATED.
6. PRODUCT UNPACKED.
6. THIS WORK ELIMINATED.
7. PRODUCT STORED AWAITING ORDERS.
7. THIS WORK ELIMINATED.
8. CUSTOMER'S ORDERS RECEIVED
8. ORDERS WRITTEN UP IN STEP 1.
9. PRODUCT RE-BOXED AND ADDRESSED TO CUSTOMER.
9. THIS WORK ELIMINATED.
10. PRODUCT DELIVERED TO CUSTOMER.
10. SAME AS PRESENT METHOD.
THIS WORK ELIMINATED UNDER NEW METHOD.

FIGURE 4.

Bell System exchanges to any other subscriber. Since 1931, Teletypewriter Exchange Service has had a steady growth, more than 200 kinds of business being represented by its users. Approximately 7500 stations scattered from coast to coast now serve more than 3000 different organizations.

While successful business operation depends in large measure upon adequate wire communication facilities allowing intimate supervision of distant units, there has to be some way of recording the details of transactions which are handled by wire. There must be office systems and equipment for the maintenance and distribution of the paper records and forms essential to modern management. Where teletypewriter service is used, practically all of these requirements are now met through the automatic reproduction of identical communications at connected points.

Business practice frequently necessitates the use of complicated forms for recording and transmitting, from one point to another, customers' orders, production reports, purchase requisitions or other matters. Several copies have to be furnished for departments performing specialized functions. While teletypewriter service was still comparatively novel in the industrial field, it was seen that, if the service could be used for "form-writing" between distant points, office routines would be greatly simplified. Experiments along these lines met with little success because it was virtually impossible to insure alignment of sheets and carbons on the connected machines. In 1928, however, a sprocket feed device was perfected which made possible the alignment of paper on two or more connected teletypewriters, no matter how far apart. The new equipment also prevented slippage of copies and carbons.

This sprocket feed feature provided additional opportunities for business to capitalize on Teletypewriter Service. It became necessary to view the service not merely as a communication link between distant offices, but also as a business tool capable of performing functions which heretofore had required

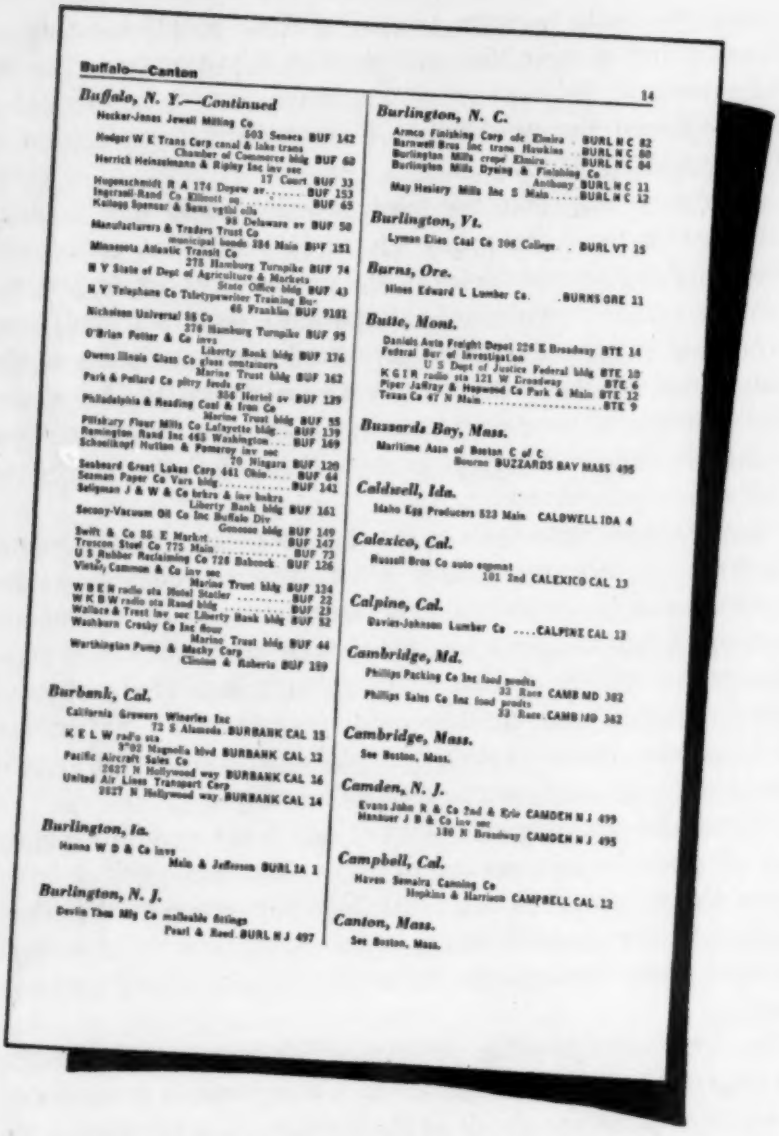
the use of many different types of office equipment. The teletypewriter could perform several of these functions more efficiently and at more than one point simultaneously. The development of Teletypewriter Exchange Service has considerably widened the possibilities for commercial application of "form writing."

The mere fact that the teletypewriter could now transfer information from one printed form to another at a distance, while making several copies in the process, did not at first appear particularly significant. Experience soon indicated, however, that this feature alone permitted rearrangements of the user's fundamental practices to such an extent that large savings in overhead were made possible. In most instances, these savings have been sufficient to more than offset the cost of the Teletypewriter Service.

Bell System representatives who coöperate with business concerns to determine how their existing communication methods can be improved now have to acquaint themselves with much that formerly was not thought pertinent to the communication study. Among many other things, the routine of office procedure must be thoroughly investigated. Experience in developing the service on this basis has shown that several outstanding advantages can usually be offered.

The major advantages, not all of which are easy to evaluate but of great importance to the user, are improved delivery speed on customers' orders, reduction in inventories, the elimination of office, manufacturing and shipping peaks, and savings brought about through the faster handling of billing and collections.

Improvements in office practice which result can generally be determined in dollars and cents. It is possible to eliminate re-writing operations at one or more offices, thus permitting the re-allocation of clerical personnel. Re-copying errors, sometimes very expensive, are eliminated simply because there is no re-copying. One typing provides identical copies in sufficient



Buffalo—Canton

Buffalo, N. Y.—Continued

14

Hecker-Jones Jewell Milling Co
503 Seneca BUF 142
Hodger W E Trans Corp canal & lake trans
Chamber of Commerce bldg BUF 60
Herrick Heinzelmann & Rigby Inc inv sec
17 Court BUF 33
Huponschmidt R A 174 Depew av BUF 153
Ingersoll-Rand Co Elliott sq BUF 65
Kellogg Spencer & Sons vgtbl oils
98 Delaware av BUF 50
Manufacturers & Traders Trust Co
municipal bonds 534 Main BUF 151
Minnesota Atlantic Transit Co
275 Hamburg Turnpike BUF 74
N Y State of Dept of Agriculture & Markets
State Office bldg BUF 43
N Y Telephone Co Teletypewriter Training Bur
60 Franklin BUF 9181
Nicholson Universal SS Co
376 Hamburg Turnpike BUF 95
O'Brien Potter & Co invs
Liberty Bank bldg BUF 176
Owens Illinois Glass Co glass containers
Marine Trust bldg BUF 162
Park & Pollard Co pltry foods gr
306 Hertel av BUF 129
Philadelphia & Reading Coal & Iron Co
Marine Trust bldg BUF 55
Pillsbury Flour Mills Co Lafayette bldg BUF 139
Remington Rand Inc 465 Washington BUF 169
Schoellkopf Hutton & Pomeroy inv sec
70 Niagara BUF 120
Seaboard Great Lakes Corp 441 Ohio BUF 64
Seaman Paper Co Vare bldg BUF 141
Seligman J & W & Co brkrs & inv brkrs
Liberty Bank bldg BUF 161
Socony-Vacuum Oil Co Inc Buffalo Div
Genesee bldg BUF 149
Swift & Co 85 E Market BUF 147
Truscon Steel Co 775 Main BUF 73
U S Rubber Reclaiming Co 726 Babcock BUF 126
Vietor, Common & Co inv sec
Marine Trust bldg BUF 134
WBEN radio sta Hotel Statler BUF 22
WKBW radio sta Rand bldg BUF 23
Wallace & Trest inv sec Liberty Bank bldg BUF 52
Washburn Crosby Co Inc flour
Marine Trust bldg BUF 44
Worthington Pump & Machy Corp
Clinton & Roberts BUF 189

Burbank, Cal.

California Growers Wineries Inc
73 S Alameda BURBANK CAL 15
K E L W radio sta
3702 Magnolia blvd BURBANK CAL 12
Pacific Aircraft Sales Co
2627 N Hollywood way BURBANK CAL 16
United Air Lines Transport Corp
2627 N Hollywood way BURBANK CAL 14

Burlington, Ia.

Hanna W D & Co invs
Main & Jefferson BURL IA 1

Burlington, N. J.

Devlin Thos Mfg Co malleable fittings
Pearl & Reed BURL N J 497

Burlington, N. C.

Armco Finishing Corp c/o Elmira BURL N C 82
Burnwell Bros Inc trans Hawkins BURL N C 80
Burlington Mills crepe Elmira BURL N C 84
Burlington Mills Dyeing & Finishing Co
Anthony BURL N C 11
May Hosiery Mills Inc S Main BURL N C 12

Burlington, Vt.

Lyman Elias Coal Co 306 College BURL VT 15

Burns, Ore.

Hines Edward L Lumber Co. BURNS ORE 11

Butte, Mont.

Daniels Auto Freight Depot 226 E Broadway BTE 14
Federal Bur of Investigation
U S Dept of Justice Federal bldg BTE 10
K G I R radio sta 121 W Broadway BTE 6
Piper Jaffray & Hopwood Co Park & Main BTE 12
Texas Co 47 N Main BTE 9

Buzzards Bay, Mass.

Maritime Assn of Boston C of C
Bourne BUZZARDS BAY MASS 495

Caldwell, Ida.

Idaho Egg Producers 523 Main CALDWELL IDA 4

Calexico, Cal.

Russell Bros Co auto equipment
101 2nd CALEXICO CAL 13

Calpine, Cal.

Davies-Johnson Lumber Co CALPINE CAL 13

Cambridge, Md.

Phillips Packing Co Inc food goods
33 Race CAMB MD 382
Phillips Sales Co Inc food goods
33 Race CAMB MD 382

Cambridge, Mass.

See Boston, Mass.

Camden, N. J.

Evans John R & Co 2nd & Erie CAMDEN N J 499
Mandeer J B & Co inv sec
330 N Broadway CAMDEN N J 495

Campbell, Cal.

Haven Semalra Canning Co
Hopkins & Harrison CAMPBELL CAL 12

Canton, Mass.

See Boston, Mass.

FIG. 5. A PAGE FROM THE BELL SYSTEM'S NATIONAL TELETYPEWRITER EXCHANGE SERVICE DIRECTORY.

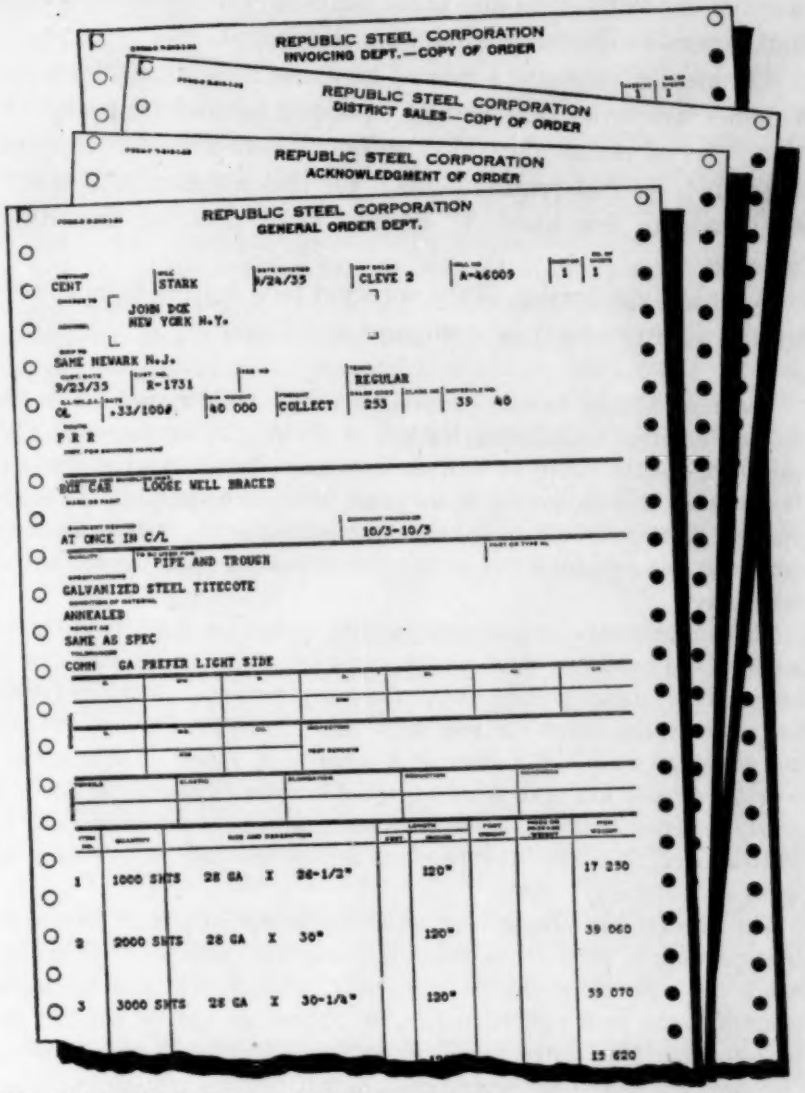


FIG. 6. THIS ORDER FORM IS TELETYPEWRITTEN IN QUADRUPLICATE AT THE YOUNGSTOWN, O., GENERAL ORDER DEPARTMENT OF THE REPUBLIC STEEL CORPORATION. AT THE RECEIVING POINT, WHICH MAY BE ANY ONE OF SEVERAL DISTANT MILLS, THE SAME INFORMATION IS REPRODUCED ON A HECTOGRAPH FORM, FROM WHICH ANY NUMBER OF COPIES UP TO TWENTY ARE RUN OFF FOR THE USE OF THE VARIOUS MILL UNITS. NOTE THE DEPARTMENTAL DISTRIBUTION INDICATED ON THE FORMS.

number for both office and plant units so that time-consuming and expensive checking is likewise eliminated.

Companies in many kinds of business have recognized the value of Teletypewriter Service equipped for multi-copy operation. As of recent date, 187 different concerns had adapted it to their special requirements. Of this number, 140 use it on a private line basis, 47 having Teletypewriter Exchange Service.

A typical application of the sprocket feed feature is described by the auditor of a food company as follows:

> The order-writing system performs a simple enough function in the modern industrial organization, but lack of efficiency in one way or another usually affects the quality of both production and distribution performance. If orders are slow in arriving at the point where they are filled, customers are kept waiting; if they are inaccurate or not authentic, there is the same delay and also a probable loss of materials or slowing-up in the production machinery.
>
> The requirements of a good order-writing system are few. It should be accurate and provide a check on this accuracy. Various agencies now in ordinary use readily provide one of these requirements. Messenger service, whereby the orders are sent from office to factory by boy, usually makes for accuracy. But there is a sacrifice of speed. The telephone provides a ready means of achieving speed in order transmission, but it is generally agreed that oral messages do not always have the authenticity of written ones. . . . The teletypewriter fulfills the two requirements of speed and accuracy.
>
> The sprocket feed arrangement, which moves the carriage of the distant teletypewriter in perfect synchronization with the carriage of the one on which the communications are being sent, is so flexible that it can be adapted to the most complicated forms. These are usually fed into the teletypewriter from large packs, forms being interleaved with carbons. One pack will usually last several days, so that frequent replacement is not necessary. Both machines print a sufficient number of copies for whatever uses the particular routine may demand.
>
> If the sender wishes to include figures or other information on his copies which he does not wish to appear on the copies at the other end, the forms can be so designed. Office copies may be printed with space for the in-

formation wanted, and the corresponding space on the receiving copies "blacked out."

Orders which come into the office by telephone, telegraph, mail, and from the salesmen, are promptly turned over to the operator. The sending machine prepares four copies of each order—an original invoice, a bookkeeping copy, a statistical copy and an office copy. Simultaneously in the factory the receiving machine prints four additional copies—a shipping order, a delivery receipt, a packing copy and an office copy.

This use of the teletypewriter has resulted in increased efficiency and considerable economy. The cost of messengers has been eliminated. Orders flow in a smooth stream from office to factory. The production department experiences no peak loads at certain times during the day; nor are there any idle periods. The order clerks in the general office may stay after regular office hours if necessary, sending orders which arrived too late to be sent while the warehouse force is working. The warehouse force, which goes to work an hour earlier than the office force on the following day, finds orders already at hand, and does not have to await the arrival of messenger or mail.

The president of a prominent automobile company cites his experience with the sprocket feed feature in an article entitled "Millions for Equipment—Not One Cent for Waste."

Teletypewriters were used in our big car plant to schedule the work and keep it flowing. When we laid out the new car plant we took every advantage of this experience. The variations and permutations possible even in so standardized a product as an automobile are almost infinite. Some 30 copies of engine specifications are necessary, including assorted variations for export shipments to conform with foreign traffic laws and meet the requirements of foreign methods of taxation. Comparable variations occur throughout. It is necessary to schedule the parts through the plant so that when they reach the assembly or sub-assembly lines the right parts meet the right assemblies. All this is handled by teletypewriter. The scheduling process has been so far refined that one chain conveyor brings radiator shelves, bonnets, front and rear fenders—in proper order and at the right moment. The entire production performance is at all times coördinated through this teletypewriter link between factory departments and the office.

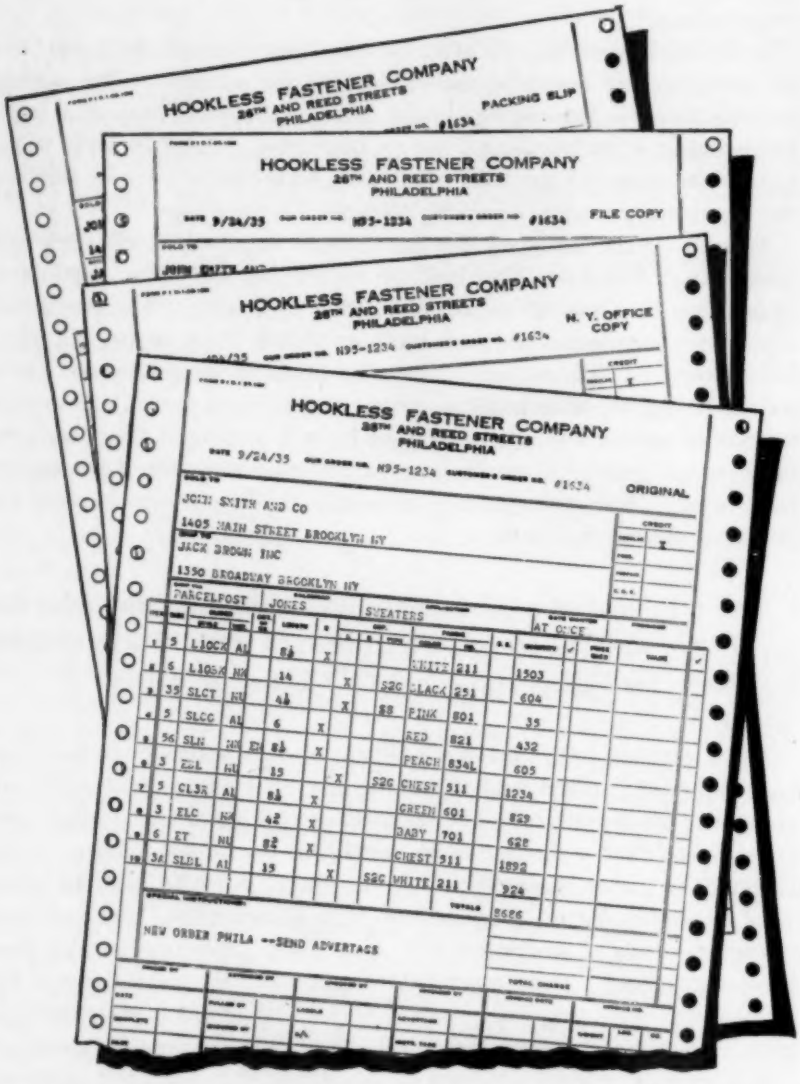


FIG. 7. THESE FOUR COPIES ARE RECEIVED AT THE PHILADELPHIA WAREHOUSE OF THE HOOKLESS FASTENER COMPANY. SIMULTANEOUSLY, THE NEW YORK HEADQUARTERS AND MAIN SALES OFFICE PREPARES ONE FILE COPY. NOTE THE DEPARTMENTAL DISTRIBUTION INDICATED ON THE FORMS.

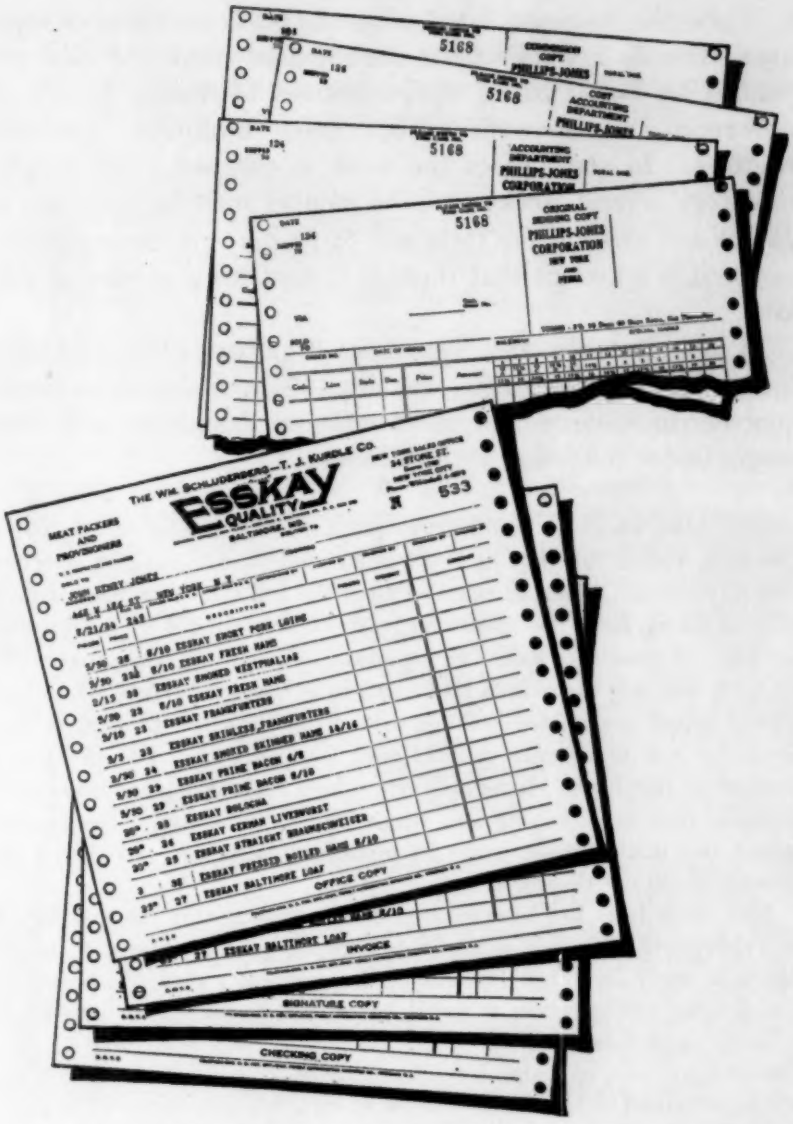


FIG. 8. ABOVE: THESE FORMS ARE PREPARED IN ONE OPERATION ON THE SENDING TELETYPEWRITER OF THE PHILLIPS JONES CORPORATION; THE PLANT AT POTTSVILLE, PA., SIMULTANEOUSLY RECEIVES FIVE ADDITIONAL COPIES. BELOW: THESE FORMS ARE RECEIVED AT THE BALTIMORE HEADQUARTERS AND PLANT OF THE SCHLUDERBERG-KURDLE COMPANY EXACTLY AS TYPED IN SALES OFFICES AT NEW YORK OR RICHMOND, VA. NOTE THE DEPARTMENTAL DISTRIBUTION INDICATED ON THE FORMS.

While the instances cited above indicate customer acceptance, they do not reflect the considerable effort and time expended by Bell System representatives in tracing details of operation and in working out these improved operating routines. In some cases the work is comparatively simple, in others several weeks or even months may be required to gather and analyze the facts and to prepare recommendations where it is apparent that there is a need for a service of this kind.

In one instance the Telephone Company representative found that a steel concern was dispatching orders from headquarters to its wire and sheet mills by telephone and messenger under the following conditions:

Four order clerks at headquarters prepared multi-copies of all orders. One man worked full time at headquarters telephoning advance information to the mills. This, in turn, required the full time of a man at each mill, in taking notes and dispatching preliminary advices to various mill sections. A messenger made two trips each day between headquarters and the mills, carrying the written confirmations of the same orders, which had been prepared in duplicate. When received at the mills the written confirmations had to be cross-checked with the pencil notations previously received by telephone. Sometimes errors were made which consumed considerable time in correcting and which were often costly. The routine caused two distinct daily peaks in production activities and slowed up delivery of customers' orders.

After these facts had been secured it was obvious that the installation of Teletypewriter Service equipped for multi-copy form operation would eliminate many inefficient features of the company's plan of operations. By applying teletypewriter it would be possible to reduce the number of full-time employees handling orders at headquarters from four to one. Men engaged in telephoning from headquarters and in taking down notes at the mills could be released to other work on a full-time basis. The order load would be eliminated from the messenger service so that the number of daily trips could be reduced from two to one. Checking of written confirmations against verbal advices would be no longer necessary. Peaks in the work load at the mill would be leveled off. As a result, customer service should greatly improve. In addition, the capacity of the Tele-

typewriter Service would permit instantaneous general communication between units, making for increased all round efficiency. Needless to say, no difficulty was experienced in convincing the prospect that the service was highly desirable, and it was installed.

The foregoing illustrates some applications of teletypewriter business systems as related to comparatively short haul requirements. Over great distances other factors generally have to be considered. The following is a case in point:

A prominent clothing manufacturer, whose business required the preparation of voluminous paper records at sales office and plant in connection with all orders handled, was unable to give customers sufficiently rapid delivery service. Formal orders had to be mailed and received at the plant before shipment could be made. In addition, a considerable investment was tied up in stocks carried at strategically located warehouse depots.

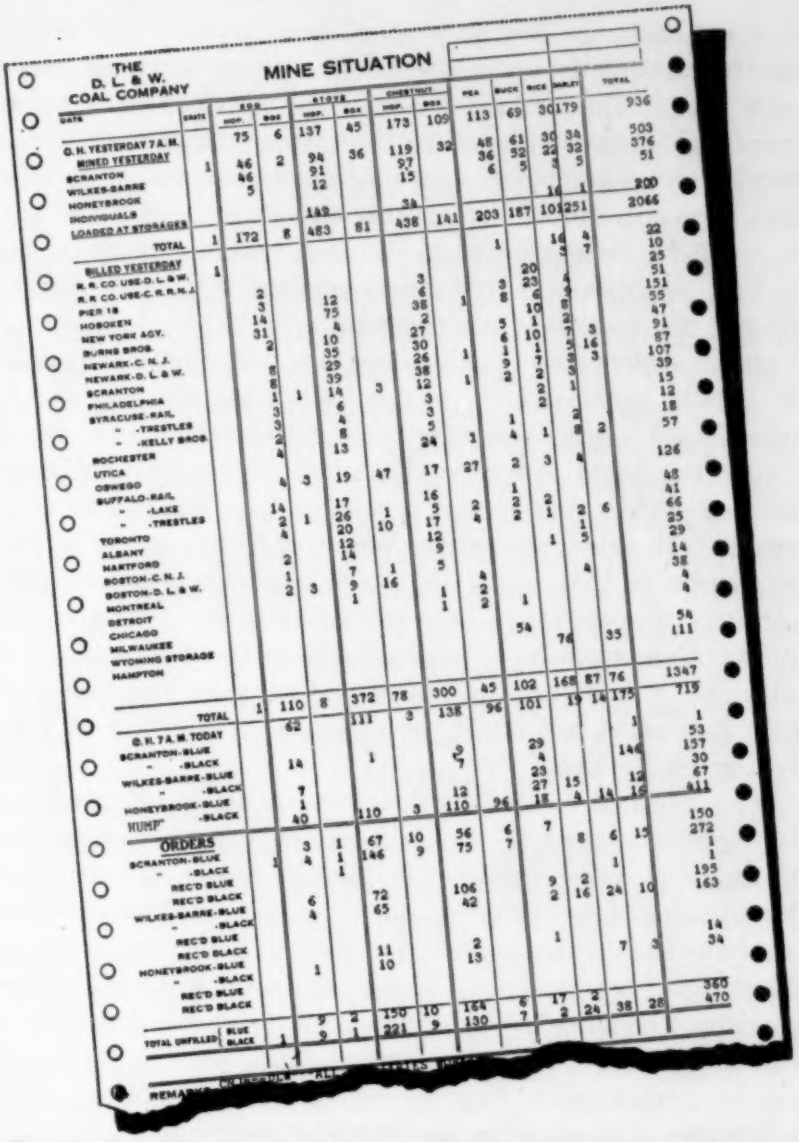
A Telephone Company representative studied the routine of operation involved, tracing the course of an order from the time it was received until shipment was made and bill rendered. More than a score of separate operations were investigated.

It was found that the sprocket feed feature of Teletypewriter Service could be employed to handle all the required paper work. In addition, the fact that orders would be transmitted instantly to the plant would enable the manufacturer to give overnight delivery on rush orders. This solved the problem of customer service and the teletypewriter recommendation was adopted.

In a short time it was found that the economies which the service effected were sufficient to more than pay for its cost. In the first place, it was possible to substantially eliminate inventories maintained at a warehouse operated in conjunction with the sales office. The automatic reproduction of paper records at both sales office and plant permitted the transfer of employees to other duties. Less office equipment was required to handle orders. An even flow of orders throughout the day resulted in additional economies in production and shipping departments at the plant.

Consumer demand dictates continuous improvements in the technique of handling orders, inquiries and shipments. Cost and competitive situations require constant search for possible reductions in overhead. Teletypewriter Service, both private

FIG. 9. SIX COPIES OF THIS FORM ARE TYPED AT THE HEADQUARTERS OF THE KRAFT-PHENIX CHEESE CORPORATION. THE SAME TYPING SIMULTANEOUSLY PREPARES THREE COPIES AT THE DISTANT FACTORY. NOTE THE DEPARTMENTAL DISTRIBUTION INDICATED ON THE FORMS.



THE D. L. & W. COAL COMPANY

MINE SITUATION

DATE	EGG		STOVE		CHESTNUT		PEA	BUCK	RICE	BARLEY	TOTAL
	HOP.	BOX	HOP.	BOX	HOP.	BOX					
G. H. YESTERDAY 7 A. M.		75	6	137	45	173	109	113	69	30	179	936
MINED YESTERDAY												
SCRANTON		46	2	94	36	119	32	48	61	30	34	503
WILKES-BARRE	1	46		91		97		36	52	22	32	376
HONEYBROOK		5		12		15		6	5	3	5	51
INDIVIDUALS										16	1	200
LOADED AT STORAGES				149		34						2066
TOTAL	1	172	8	483	81	438	141	203	187	101	251	
BILLED YESTERDAY								1		16	4	22
R. R. CO. USE-D. L. & W.	1					3				3	7	10
R. R. CO. USE-C. R. R. N. J.						6			20			25
PIER 18		2		12		38	1	3	23	4		51
HOBOKEN		3		75		2		8	6	4		151
NEW YORK AGY.		14		4		27		5	10	8		55
BURNS BROS.		31		10		30	1	6	1	2	3	47
NEWARK-C. N. J.		2		35		26	1	1	10	1	16	91
NEWARK-D. L. & W.			8	29		38		9	7	3	3	87
SCRANTON			8	39		12	1	2	1	2		107
PHILADELPHIA			1	14	3	3			2	2		39
SYRACUSE-RAIL			3	6		3			2	1		15
" -TRESTLES			3	4		5		1		2		12
" -KELLY BROS.			2	8		24	1	4	1	8	2	18
ROCHESTER			4	13								57
UTICA						17	27	2	3	4		126
OSWEGO		4	3	19	47							
BUFFALO-RAIL						16		1				48
" -LAKE		14		17	1	5	2	2	2			41
" -TRESTLES		2	1	26	1	17	4	2	1	2	6	66
TORONTO		4		20	10	12				1		25
ALBANY				12		9				1	3	29
HARTFORD		2		14								14
BOSTON-C. N. J.		1		7	1	5				4		38
BOSTON-D. L. & W.		2	3	9	16		4					4
MONTREAL				1		1	2	1				4
DETROIT						1	2					
CHICAGO								54				54
MILWAUKEE									74		35	111
WYOMING STORAGE												
HAMPTON												
TOTAL	1	110	8	372	78	300	45	102	168	87	76	1347
G. H. 7 A. M. TODAY		62		111	3	138	96	101	19	14	175	719
SCRANTON-BLUE											1	1
" -BLACK		14		1		9		29				53
WILKES-BARRE-BLUE						7		4			146	157
" -BLACK		7						23				30
HONEYBROOK-BLUE		1				12		27	15		12	67
-BLACK		40		110	3	110	96	18	4	14	16	411
"UMP"												150
ORDERS		3	1	67	10	56	6	7		6	15	272
SCRANTON-BLUE	2	4	1	146	9	75	7		8			1
" -BLACK			1							1		1
REC'D BLUE								9	2			195
REC'D BLACK		6		72		106		2	16	24	10	163
WILKES-BARRE-BLUE		4		65		42						
" -BLACK												14
REC'D BLUE						2		1		7	3	34
REC'D BLACK				11		13						
HONEYBROOK-BLUE		1		10								
" -BLACK												360
REC'D BLUE						164	6	17	2			470
REC'D BLACK				150	10	130	7	2	24	38	28	
TOTAL UNFILLED BLUE		9	2	221	9							
BLACK	1	9	1									

REMARKS

FIG. 10. THIS MINE SITUATION REPORT IS TELETYPEWRITTEN AT THE SCRANTON, PA., MINE OFFICE OF THE D. L. & W. COAL COMPANY AT 9:00 A.M. DAILY, AND FIVE COPIES ARE SIMULTANEOUSLY REPRODUCED AT THE MAIN SALES OFFICE IN NEW YORK, FOR THE USE OF VARIOUS DEPARTMENTS. AS ORDERS ARE RECEIVED DURING THE DAY AT NEW YORK FROM BRANCH SALES OFFICES, THIS REPORT ENABLES THE COMPANY TO DETERMINE AT ONCE HOW MUCH OF EACH ORDER CAN BE FILLED IMMEDIATELY AND WHAT ADDITIONAL PRODUCTION IS REQUIRED AT THE MINE.

line and exchange, has been valuable to industry in these respects, particularly where operating units are scattered over a wide area. The successful commercial application of equipment for "form writing," actually turning a communication service into a combination of office and communication services, demonstrates in yet another way how readily the teletypewriter can be adapted to the most exacting requirements.

The establishment of Teletypewriter Exchange Service opened up an entirely new communication field. It is used to transmit orders and specifications and shipping instructions, to handle financial and commodity market transactions, to interchange information relative to market conditions, prices, credit, purchases and general administration. A substantial number of these matters had previously been handled by other means. However, the service was so well adapted to various requirements that many industrial concerns modified their methods of operation to take advantage of its distinctive features. Consequently, a large portion of the communications which are now sent by this means did not exist and would not have originated had it not been for the introduction of Teletypewriter Exchange Service.

This form of communication is particularly advantageous to organizations whose requirements have not yet developed to the point where Private Line Service would be warranted. By utilizing Teletypewriter Exchange Service initially, they are later enabled to contract for Private Line Service with a minimum of rearrangement of their operating methods. Many concerns who already had Private Line Teletypewriter Service frequently have peak requirements during certain periods in excess of what can be handled over their private lines. Teletypewriter Exchange Service provides a means of handling this overflow, besides allowing for general intercommunication with other subscribers to the service.

J. M. TUGGEY, JR.

Answering Stockholders' Letters by Telephone

THE Treasury Department of the American Telephone and Telegraph Company is a primary point of contact between the Company and its stockholders. The Department is continuously busy with stockholder service. There are hundreds of changes of ownership each day through the process of stock transfers; every three months about 670,000 dividend checks are mailed; and the Treasury Department records yearly more changes of address than there are people in the average fair-sized American city. The transactions arising out of this activity are conducted through three main channels: first, by counter service in the lobby at 195 Broadway; second, by correspondence; and, third, by telephone.

An interesting experiment has been conducted during the past four years in transferring some of the replies to the incoming letter contacts from the correspondence to the telephone medium. This has been done principally to improve certain services rendered to stockholders, but also to give a model demonstration to many stockholders of the communication facilities of which they are part owners, and, not of least importance, to stimulate toll usage.

The experiment grew in a gradual manner from 1921 to 1930 out of experiences during the periodical offers of new stock to stockholders for subscription. Incoming telephone calls from stockholders increased enormously during the subscription periods and at the same time it became expedient to answer a few urgent letters by telephone. During the 1926 stock issue, incoming calls were concentrated at a central point, and during the 1928 issue a 120-line 8-position order table was installed. The result was that much speedier replies were given

and, because of a special course of instruction, a much better-rounded and more efficient service was furnished. Also, since the equipment was located near the point where letters were being handled, the answering of letters by telephone was more and more enlarged.

The 1928 experience was so successful for stock issue purposes that the equipment was again installed in connection with subsequent subscription offers, concluding with the 1930 stock issue. Since the latter work expired, the equipment has remained in the Treasury Department and has been the nucleus for the steadily increasing development of telephone contacts with stockholders.

1,000 Letters a Month Now Answered by Telephone

Upwards of 300,000 incoming calls have been received and handled in this unit since stock issue work subsided, exclusive of requests for stock market quotations, which, due to the interest in the Stock Purchase Plan of the Bell Telephone Securities Company, were rather numerous at first; but of greater significance is the fact that, during this same period and arising from meagre beginnings in conjunction with stock issues, approximately 50,000 letters have been answered by telephone, or an average of almost 1,000 a month. At the present time approximately 23 per cent of the correspondence with stockholders which requires answer receives telephonic reply. These letters have been of many types, some pertaining to transactions involving thousands of dollars' worth of telephone securities and some others giving simple information, such as dividend record dates, but practically all have been direct with stockholders or their representatives.

Concentrating the incoming calls at the order table resulted in several obvious advantages, particularly from the point of view of giving the specialized service which calls from stockholders deserve. It was found, however, that the calls were subject to peak-loads in certain hours of the day, and expand-

THIS 120-LINE 8-POSITION ORDER TABLE IS ONE OF THE MAIN POINTS OF CONTACT BETWEEN THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY AND ITS STOCKHOLDERS.

ing the use of the telephone in answering letters tended to occupy the slack periods resulting from this situation.

At the time this expansion occurred, it was not an original idea in the Bell System. Commercial service and sales promotion efforts had included it for many years. Also, business houses of many descriptions have for years used calls inside areas where it is cheaper to telephone than to write, and such houses have naturally answered letters from customers within these areas in the same way. It has, therefore, long been recognized that the telephone call has advantages in such directions as flexibility, speed, persuasiveness, and personal relationships.

The significant and original angles to the Treasury Department experiment lay in the extension of this previously accepted area and to the application of the telephone to financial and fiduciary correspondence, for which the written record was previously thought indispensable. Results obtained during stock issues, in terms of good service and better public relations, showed that a real opportunity existed to add a "personal touch" and to stimulate tool usage by furnishing a good sample product; at the same time, the results also proved that oral transactions in this field could be entirely satisfactory.

How the Telephone Area Was Established

After these conclusions were reached, it became necessary to determine within what distances routine calls might wisely be made and which correspondence topics might safely be handled by telephone. Several studies were made to help in reaching decisions upon these two problems. To begin with, about 1300 pieces of incoming mail were reviewed. Those letters better handled by printed or processed form reply and those letters which required as a part of the reply one or more accompanying forms were first eliminated. The remaining cases, after certain minor eliminations, amounted to 563, and the probable telephone cost required to answer these was com-

puted. This involved computation of the total cost and the per case cost of the actual number of cases within each regular commercial person-to-person rate band or zone, and, finally, computation of the cumulative cost per case in groups of zones. The results of this computation were as follows:

Rate Zone (Person-to-Person Rates)	Total Cases	Total Costs	Average Cost	
			Per Case in Each Zone	Per Case Cumulative
$.0375–$ 1.00	217	$ 59.09	$ .27	$ .27
$ 1.05–$ 2.00	110	153.42	1.39	.65
$ 2.05–$ 3.00	52	129.05	2.48	.90
$ 3.05–$ 4.00	100	379.00	3.79	1.50
$ 4.05–$ 5.00	23	109.50	4.76	1.65
$ 5.05–$ 6.00	7	39.00	5.57	1.70
$ 6.05–$ 7.00	7	44.50	6.35	1.77
$ 7.05–$ 8.00	10	74.75	7.47	1.87
$ 8.05–$ 9.00	2	17.00	8.50	1.90
$ 9.05–$10.00	5	48.25	9.65	1.97
$10.05–$11.00	18	197.75	10.98	2.27
$11.05–$12.00	12	135.25	11.27	2.46
Totals	563	$1386.56	—	$2.46

The problem was to determine the point at which the importance of the subject matter of the average call would approximately balance with the average cost thereof. Such factors were given consideration as the speed required in handling the calls, the relative expense of the telephone personnel as compared with the personnel required to turn out written replies, and many similar factors. Some of the latter, however, were of such variable and intangible nature that it was not practicable to attempt an exact cost comparison of the two media, but it was felt that the greater production rate of the telephone tends to level off the costs to a comparable basis without taking into consideration other elements which favor the telephone.

More or less as an experiment, the area within which the person-to-person rate would not exceed $2 was selected for the routine telephone calls. This area includes all of New Eng-

CALLS ARE MADE TO ALL POINTS WITHIN THE $2 PERSON-TO-PERSON RATE ZONE, AN AREA IN WHICH 60 PER CENT OF THE STOCKHOLDERS OF THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY ARE LOCATED. IN ADDITION, CERTAIN CITIES JUST OUTSIDE THE ZONE, SUCH AS MONTREAL, WHEELING, AND LYNCHBURG, ARE CALLED.

land except the northeastern part of Maine, a portion of Canada including Toronto, all of the states of New York, Pennsylvania, New Jersey, Delaware, and Maryland, and about half of Virginia and West Virginia. Over 60 per cent of the stockholders of the Company are located within these bounds.

The average cost per call in the preceding table for this area is shown as 65 cents, but in actual experience over a period of years this has been somewhat less. It soon developed that a very considerable number of the calls could be handled on a station-to-station basis and it has been the accepted practice to originate as many station-to-station calls as possible. Bank officers, attorneys, and individuals whose letterheads show business, hotel or institutional addresses can be called at the lower rate with assurance of a high percentage of completion on the first attempt.

It should not be inferred from this description that the limited area needs to be too rigidly established. It is applied only to the routine or average correspondence calls. There are many emergency cases which warrant telephone treatment outside the $2 area.

How the Types of Letters to Answer Were Selected

Selection of appropriate types of letters to answer by telephone was approached in a different manner. Originally only two kinds had been handled, one being those of an emergency character and the other being cases where additional information was required in order to reply properly by letter. Also, many of the first type were confirmed later in writing.

As the use of the telephone in answering general stockholder mail expanded, it was natural that new steps should have been taken cautiously and that simpler types of cases should have been attempted first. Telephone replies, therefore, were confined at the beginning largely to general inquiries from stockholders in which it was clearly obvious that a written reply would not be very necessary. There are always some stock-

holders, for instance, who are confused about the dates upon which they should receive their dividend checks. Letters arrive in all the non-dividend months of the year, ranging in tone from criticism over supposed carelessness to fear that the dividend may have been passed. These yield themselves to pleasant and successful telephone conversations with stockholders in conveying the correct information.

Other types of general inquiries which were answered by telephone in the early days of the experiment pertained to the dividend rate, general data concerning stock transfer requirements, acceptable forms for registering stock, certain Company practices regarding this, and complying with simple requests such as acknowledging change of address orders.

Although practically all of this correspondence may be called stockholder mail, it should be recognized that a fairly large percentage of it is received from representatives of the stockholders, such as banks, trust companies, lawyers, and brokers. In the quality of service which the Treasury Department endeavors to provide, no distinction is made between a letter received from a stockholder direct and one from a bank or other agent on behalf of a stockholder. However, the technique of handling telephone conversations with the professional representatives of the stockholders is different from that of dealing direct with the individuals. In fact, it may be said to be easier, since the occasional technical language required is more familiar to the professional man than to the average stockholder.

The Full List of Topics

Results from these activities were favorable from several points of view, including that of giving effective answers to the incoming letters. The oral responses of the recipients were for the most part agreeable and there was exceedingly little aftermath of the calls, such as requests for confirmations or further letters indicating an unsatisfactory outcome of the con-

versation. This success led to additional types of letters being assigned for telephone treatment within the prescribed zones, and in 1931 the approved list embraced 33 general topics, including some of the most complicated and important mail handled by the Treasury Department with stockholders. The list may be summarized as follows:

1. General inquiries regarding dates, amounts and delivery of dividends; simple stock transfer requirements; acceptable forms for registering stock; procedure for registration and exchange of bonds.
2. Specific inquiries about lost, stolen or destroyed dividend checks; non-receipt of dividend checks; dividend amounts thought incorrect; changes of address where accounts cannot be located; changes of address where acknowledgments are requested.
3. Originating calls about stock surrendered for transfer where additional requirements must be fulfilled; specific inquiries about changes of name by marriage and about the delivery of stock certificates.
4. Originating calls about bonds surrendered for registration, exchange, or conversion where additional requirements must be fulfilled; specific inquiries about payment of coupons or interest and about the delivery of bonds.
5. Miscellaneous inquiries, such as market prices of Bell System securities, delivery of annual reports or proxies to annual meeting; follow-up of cases previously handled that are still incomplete.

The list of topics had almost a three-year trial, during which many interesting experiments were conducted and the technique of handling the calls developed and improved. As a by-product of the work, the existence of the telephone unit became known to banks and brokers having a large volume of business with the Treasury Department and this had the natural result

of increasing certain incoming telephone calls and thereby decreasing incoming correspondence.

It must not be concluded from this description that the expansion of the list of acceptable topics for telephone treatment has progressed without difficulties, nor that the full list approved in 1931 is still effective. As a matter of fact, the present acceptable list is somewhat smaller than in 1931 because experience disclosed that certain types of cases yielded partially unfavorable results. In measuring results of this new process, too much reliance could not be placed upon the idea that absence of complaints indicated success. The well-known tendency of the American public not to register its complaints had to be given some consideration, and imagination had to be used to picture how persons were reacting to the novelty of receiving long distance telephone calls in response to written business communications.

Tests of the Results of Telephone Contacts

The principal factors which have led the Treasury Department to believe its telephone treatment has been worth-while may be mentioned briefly as follows:

1. The percentage of cases where written confirmations of calls have been requested has been exceedingly small: less than one-half of one per cent.
2. The percentage of cases has been negligible where the telephone contact disclosed impracticable conditions for delivering the message, such as deafness or illness. (One attempt to reach a stockholder who proved to be deaf resulted in a sale of amplifying equipment.)
3. The voice tones and oral responses of recipients of calls have been favorable in the predominant number of cases.
4. The results of calls have been generally favorable where the cases involved subsequent action on the part of the stockholders.

Another factor, which was not exactly a test of the reception of calls but which was closely allied to it, was that the percentage of cases where it proved impossible to reach the stockholder by telephone was reasonably small: namely, 6.7 per cent. This covered such familiar reasons as "No Listing," "No Answer," "Temporary Disconnect" and the like. An amusing example of an unsuccessful attempt to reach a stockholder was one where the address was given as a certain number on Hunter Street in Ossining, New York. It was found that the only telephone at that address was listed for the state penitentiary and the management would not call the stockholder to the telephone.

Types of Letters Not Answerable by Telephone

Unfavorable results were usually determined from subsequent developments in connection with telephone replies revealing that the stockholder had only partially fulfilled the Company's request or had ignored or misunderstood it. Immediately unsatisfactory oral responses to calls have been so rare that it is difficult to recall an instance. From these reactions, however, it was learned by actual experience over a period of time that it was advisable not to give routine telephone treatment to certain types of cases. In general, these have the following characteristics:

1. Where the stockholder or his representative is asked to send the Company an affidavit or other document which should preferably follow the Company's own model.
2. Where the point under discussion is one of involved figures or registration of stock and any error or misunderstanding might require subsequent correspondence.
3. Where data being conveyed by the Company comprise too many items, such as the numerous requirements necessary in a complicated fiduciary stock transfer.

4. Where the data under discussion are of a technical nature and it seems the recipient is likely to misunderstand the technical terms.
5. Where the topic under discussion is a complaint or of a controversial nature.*

Throughout the many months during which these guideposts were being determined there were many interesting episodes and pleasant contacts, the most interesting of all, of course, being those which inspired appreciative remarks or tended to stimulate the use of the telephone. One of the most clearcut examples of the latter, but by no means a lone instance, was a call originated to an attorney in Buffalo, New York, about a stock transfer requiring some additional legal papers. After the subject matter of the call had been discussed, the attorney related that he had a case in his office on which it was necessary to consult with another attorney located in Washington, D. C., and he had been debating with himself all morning whether or not a telephone call would prove satisfactory. He stated that our call had convinced him that he could transact his business with Washington over the telephone and that he would put through the call immediately.

At other times the stockholders receiving calls, particularly in small country towns, are very much pleased, not only at receiving such prompt attention to their letters, but also over the experience of a long distance call. "New York? Oh! I have never talked to New York before" is a common response to such calls and there is no doubt that the thrill is recited to many of such stockholders' friends before it is relegated to a commonplace recollection.

* *Note:* It is frequently very desirable to handle these by telephone, but in dealing with stockholders, and particularly with their legal representatives, it has been found diplomatic that such calls be made by an officer of the Company. They are therefore not classified as suitable for routine telephone treatment.

Some Favorable Reactions to Service Rendered

Reactions to the quality of the service being rendered are perhaps the ones most gratefully expressed. This may be because they come from stockholders who realize it is their own Company rendering such service. In tracing stockholders in order to forward dividend checks which have been returned undelivered, such responses are particularly common. In one memorable instance a stockholder was traced from a small New England town to several addresses in Philadelphia, thence to Norfolk, Virginia, and when he was actually located he was most surprised; first, because the Company had been able to find him and, second, because it took the trouble to do so.

One aspect of this work which in the experimental stages was thought to be a possible weakness was that a busy executive or professional man who took the trouble to write the Company a letter might prefer a written reply and might resent the interruption of an unexpected telephone message. Like many things in this world which seem obvious, however, this conclusion has not proved true in actual experience. In fact, some such calls have ended in the recipient inquiring about the Company's practice of answering letters by telephone and, after receiving a brief explanation, offering favorable comment or asking about the results.

Much additional evidence has been collected on this point. If the call being made is one of the accepted types for telephone treatment, it is usually of a personal nature. It frequently confers a favor upon or at least renders a valuable service to a stockholder or his representative, and more often than not there is dividend money or security value involved in the transaction whereby the correspondent profits through prompt attention. These factors usually set the tone for the receipt of the call, no matter how much of an interruption it may have been. This deduction is based on very thorough experimentation, including calls to many types of people. The housewife, maid, and

college student have been tried, as well as business men and prominent people. Among the latter have been officers of the army and navy, state and city officials, judges, actors, and musicians, a college professor of economics and international monetary authority, college presidents, one or two authors, and a famous comedian. No prominent stockholder has yet voiced an objection to such a call.

Proof that this work has contributed to the nation-wide efforts of the Bell System to stimulate toll business has been evidenced in several ways, but frequently by the comments and questions which arise daily in connection with both incoming and outgoing calls. Often the conversation turns to telephone usage. When it does, the Treasury employees handling the calls, of course, are not quite so rapid with their accustomed firm but polite farewells. Some samples of the kind of questions which are asked are as follows:

"How do I go about making a call to London?" (or it may be Paris, Honolulu, Java, or other overseas points).

"Can you hear well on a ship to shore hook-up?"

"How can I arrange a visit to a central office?"

"How much does it cost to call Portland, Maine?"

"How do I get a pass to a radio broadcast?"

When headline events occur in the outside world, stockholders who happen to be calling the Treasury Department, or are called by the latter, become quite friendly and gossipy, both giving information and requesting it about the latest developments in the current event. This happens invariably during such occurrences as the World Series baseball games, the international yacht races, championship tennis matches, or, more recently, during the Hauptmann trial and the Supreme Court's important decisions.

The Personnel

A very important element in successful telephone contacts with stockholders is, necessarily, the personnel handling the

calls. They need to be exceptionally trained in two distinctly different directions, one being the technique of conversing over the telephone in an agreeable though not too punctilious manner, and the other being a clear grasp of many different fields of information. Thus the post of telephone correspondent or specialist ranks high in importance in the Treasury Department's work. Candidates are carefully selected and trained, and have a thorough knowledge of all sections of the work pertaining to stockholders' records and stock transfer procedure, as well as a varied knowledge of many phases of Bell System activities.

Briefly, the general conclusions which may be drawn from the Treasury Department's four-year experience with the substitution of the telephone for the letter as a medium of answering stockholder correspondence may be summarized as follows:

1. The results as to quality of service in the average case handled are not merely "just as good," but are better.
2. The telephone provides actual money-saving economy in nearby areas.
3. Beyond the local areas the telephone enables the Treasury Department to render a rather conspicuous service, which emphasizes the "personal touch."
4. Telephone treatment of stockholder correspondence contributes to the nation-wide policy of the Bell System of endeavoring to stimulate toll usage.
5. This practice, over a period of years, is familiarizing an ever-increasing number of the Company's stockholders with a model sample of their Company's product.

J. K. TORBERT

Twenty Years of Transcontinental Service

MORE than eight hundred persons talk across the continent every business day over long distance telephone circuits. The connections are, in most cases, completed while the calling party holds the line. The ease and almost commonplaceness of transcontinental telephone conversations are apt to make us forget the beginnings of this service, initiated some twenty years ago, and the large construction project carried out at that time along lines indicated by new scientific developments. We may even lose sight of the constant effort which has been expended since that time and the consideration still being given to improving the efficiency of the plant and operating methods. This year marks an appropriate occasion to review the development of the present system of transcontinental lines and circuits, the first of which was dedicated to the public service in 1915.

The first successful coast to coast telephone circuit marked a very significant stage in a long struggle to extend the distance over which telephone communication could be conducted —a struggle which began with the two-mile line between Boston and Cambridge in 1876 and which, in 1911, had advanced to the 2200-mile line between New York and Denver. The opening of service between New York and Chicago in 1892 and between New York and Omaha in 1897 had been momentous events in this westward march of the long distance telephone. The facilities for making these earlier extensions possible were limited, in general, to large-gauge wires and the application of loading coils to them.

First Transcontinental Telephone Line

Shortly after the invention of the telephone, a comprehensive national and international telephone service was envis-

aged, but no one knew how it could be accomplished. About 1910, the officials of the American Telephone and Telegraph Company decided that a definite project of providing means to give transcontinental telephone service should be undertaken and that the West and East should be connected by telephone not later than the opening of the Panama-Pacific Exposition in 1915. The engineers and plant men to whom the order was given to provide the service realized that while existing methods, facilities, and equipment constituted a good foundation for the job ahead, they were inadequate for the operation of such a long telephone circuit, and that new methods were essential. Hundreds of miles of wire remained to be strung and thousands of poles set, in order that a continuous circuit might be available between New York and San Francisco. This, in itself, was a large undertaking, but the unanswered question that kept arising was how to overcome the great loss which the speech currents would encounter. The need was for line circuits of improved electrical characteristics and for a repeater which at the end of a long section of line would take the weak electrical currents, which carried the human voice, increase their strength, and pass them on to another section of line without appreciable distortion or delay.

Research efforts were concentrated on this problem, and as a result new loading coils and methods were made available and there was developed a vacuum tube amplifying device which was destined to be of fundamental importance to the art of electrical communication. The design of this device, as constructed for use with the proposed transcontinental line, was similar in principle to the two-wire telephone repeater of today. It appeared that the application of the two developments just mentioned to lines of the types previously used for long distances would overcome most of the difficulty which stood in the way of talking across the country.

By the early spring of 1914, pole lines totalling about 600 miles had been built in the final sections between Denver and

Reno and one group of four eight-gauge copper wires had been strung and loading coils installed at about eight mile intervals. In addition, wires had been strung and reloading and retransposing carried out on various sections of existing lines, in order that continuous circuits of the desired electrical characteristics might be available from New York to San Francisco. Cable was avoided as far as was physically possible because of the greater transmission loss which it introduced and the eastern open wire terminal was brought to within three blocks of the Hudson River. The amplifying devices, which had only recently been developed, were installed at Pittsburgh, Omaha, and Salt Lake City to overcome part of the loss to the speech currents caused by the 3300 miles of loaded copper conductors. The wires from both the East and the West were terminated at Chicago, Omaha, Denver, and Salt Lake City, and when connected at these points there was available a group of conductors with three repeater points giving the possibility of three direct telephone connections across the country. Further, it was possible at either New York or San Francisco to switch these transcontinental connections to other cities on the two coasts. Four telegraph circuits were also obtained from the wires used simultaneously for telephone purposes.

Service Opened in 1915

With these facilities, telephone service across the continent was opened on January 25, 1915, with an impressive ceremony in which President Wilson participated. Various city officials in New York and San Francisco, Dr. Alexander Graham Bell, Thomas A. Watson, and executives of the telephone company also took part. Although the transmission characteristics of the circuits were the very best that could be obtained at the time, they were poor by comparison with present day standards. For example, the frequency band transmitted was only about 900 cycles wide, or far less than one-half of the band

now used. However, those who participated in the opening and subsequent public demonstrations marveled at the achievement and congratulated the telephone company on the excellence of the results. The transmission of speech across the continent narrowed the conception of the great distance between the Atlantic and Pacific Oceans.

Removal of Loading Was First Major Improvement

Early in 1915 three repeaters were added to transcontinental connections and again in 1918 two more repeaters were installed on the wires, bringing the total number of amplifying points in a transcontinental connection up to eight. These and other improvements gave reasonably good telephone service over the circuits until 1920. This year marked the completion of a general program which had been undertaken some years before to improve the transmission substantially. The first step in this program had been the removal of the loading coils from the original eight-gauge open wire facilities. This permitted a large increase in the width of the frequency band transmitted and a resulting direct improvement in fidelity of transmission. Existing repeaters were replaced with an improved type and four new repeater points were established to make up for the increased loss caused by the removal of the loading. Telephone circuits with so many repeater points were without precedent, and the additions were made slowly because of the uncertainties as to the performance of such a circuit and the necessity of avoiding any arrangement which would react unfavorably on the transmission as it existed.

The overall result of this work was a reduction in the transmission loss on the circuit from 20 db to 12 db. This meant that the received power was increased from 1/100th to 1/16th of the transmitted power. At the same time the transmission variations due to wet weather were greatly reduced and the quality of transmission was much improved. More important,

the way was opened to the future application to the wires of carrier telephone and telegraph systems, as described later, which would have been impossible if the loading coils had not been removed.

Establishment of Additional Routes

There was a steady increase in the demand for the use of transcontinental telephone service, so that as the years went on many additional wires were strung on the original transcontinental line through Denver, Salt Lake City, and Reno. Transcontinental lines over other routes were also constructed as the traffic increased, in order to protect the service by alternate routes and at the same time give other sections of the country more direct access to the improved network of long telephone circuits.

The three circuits originally provided on the central transcontinental route proved adequate to meet the service demands until 1923, when it became necessary to provide additional circuit facilities. In view of the fact that a large part of the business terminated at Los Angeles, it was decided to provide additional facilities over a line from Denver via El Paso and Yuma to Los Angeles, which was designated the "southern transcontinental route." This route was more than 200 miles shorter for much of the Los Angeles traffic and had the added service advantage of providing an alternate route for the east and west business through a territory relatively free from sleet storms. A non-loaded eight-gauge group of copper wire was completed on the southern route in 1923 and placed in service the latter part of that year.

In 1927 a northern transcontinental line by way of Minneapolis, Bismarck, and Helena to Seattle was placed in service. A fourth transcontinental line was established in 1930 between St. Louis and Los Angeles, using a route somewhat north of the southern transcontinental line, and passing

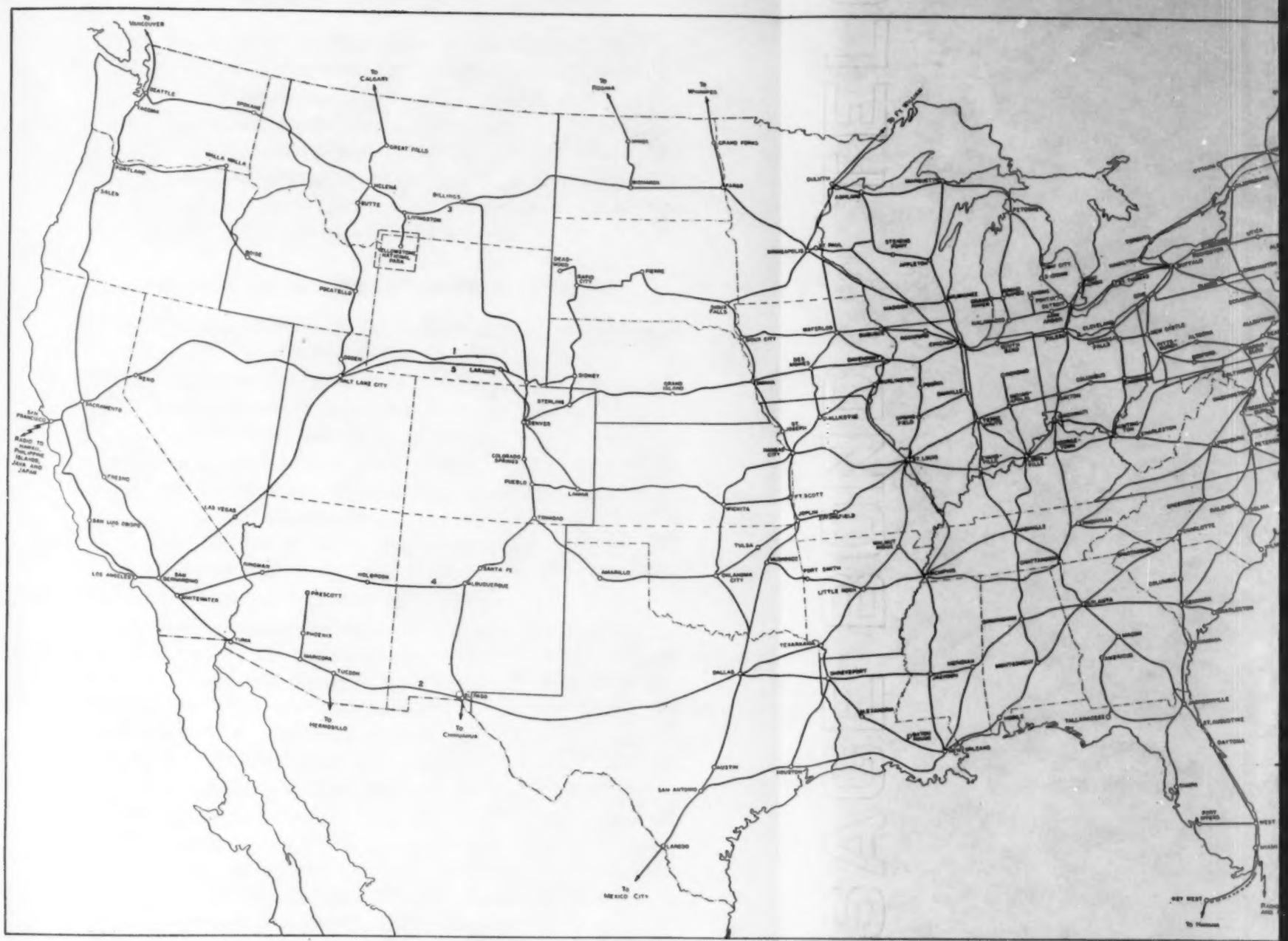
through Holbrook and Kingman, Arizona. Construction work had also been started in 1929 on other sections of line which closely paralleled the original transcontinental line between Denver and Salt Lake City and extended from that point direct to Los Angeles by way of Las Vegas, Nevada. This system of transcontinental routes has made it possible to give much better service and it provides a fundamental network on which circuits can be added as future requirements develop.

Toll Cable Circuits Added to Improve Reliability

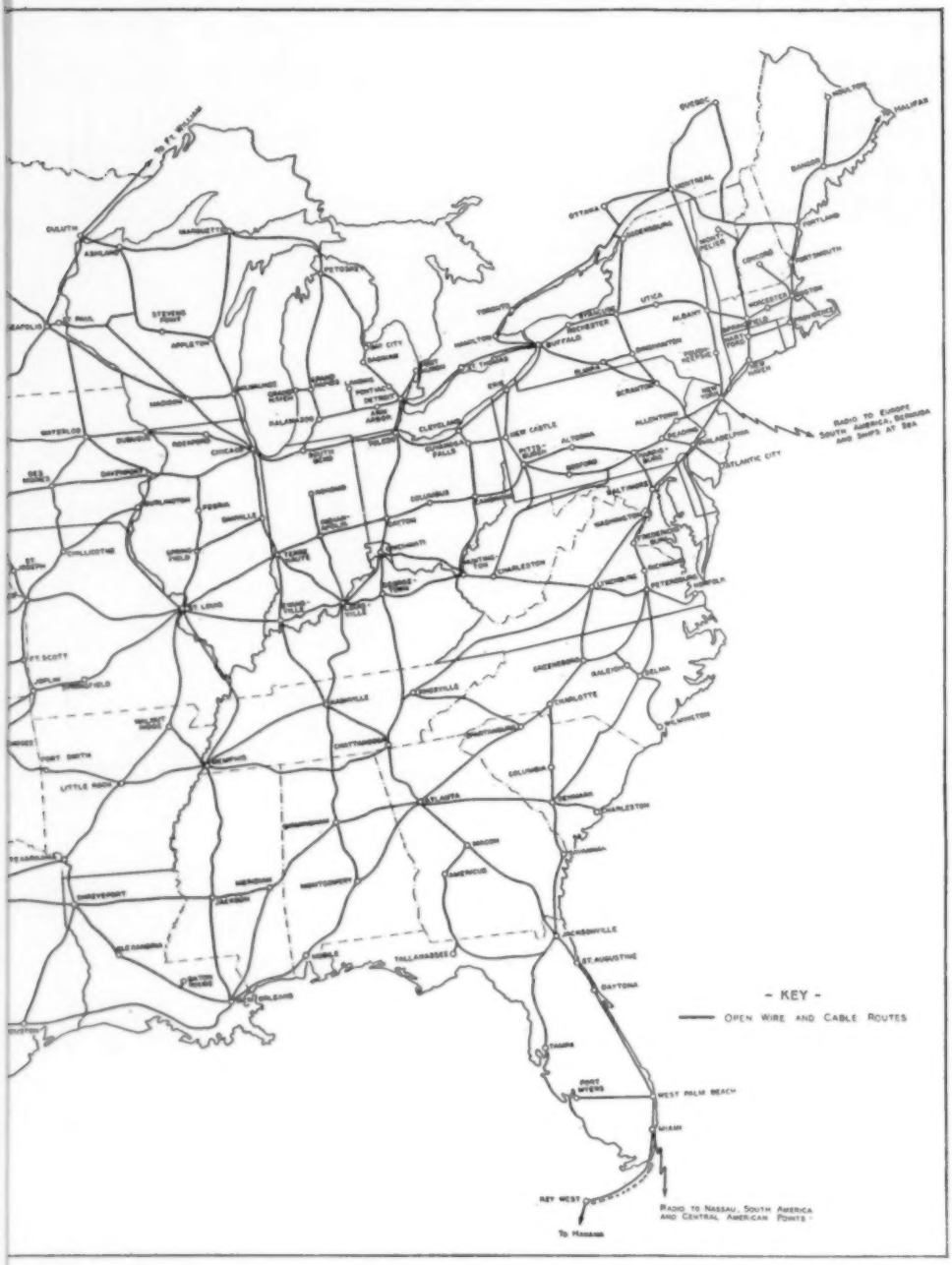
As improved methods were developed, they were applied to the transcontinental circuits so that the quality of the service might be the best that available methods would permit. One important application of these developments was the substitution, as far as practicable, of wires in lead covered cables for the open wire conductors. The use of conductors in cables for long toll circuits developed rapidly following 1920, and as the cables were extended westward from New York, sections were added to the transcontinental circuits. In 1925 the New York-Chicago cable was completed and transcontinental services were placed on four-wire cable circuit facilities in that section. The result was greater freedom from interruption caused by weather conditions and improved transmission and stability.

In 1931, when cable facilities had been extended as far west as Omaha, some of the transcontinental circuits were placed on four-wire cable facilities from New York to that point. The completion of cable from St. Louis via Kansas City and Oklahoma City to Dallas provided additional points at which the open wire transcontinental routes could be connected to the cable system. In the meantime, cables had been installed from San Francisco to Sacramento and from Los Angeles to Whitewater.

Thus we find that whereas one of the most important



THIS MAP SHOWS SOME OF THE ROUTES USED FOR THE LONGER BELL SYSTEM TELEPHONE AND TELEGRAPH CIRCUITS. THE NUMBERS INDICATE THE ORDER IN WH
THE TRANSCONTINENTAL ROUTES WERE ESTABLISHED.



NE AND TELEGRAPH CIRCUITS. THE NUMBERS INDICATE THE ORDER IN WHICH
S WERE ESTABLISHED.

engineering problems in the design of the original transcontinental circuits in 1915 was the avoidance of cable, every effort in recent years has been to place these circuits in cable in all long sections where it is available. This has been made practicable as a result of developments in cable circuit design. In some of the circuits about 45 per cent of the mileage is now in cable, while in the original circuits, cable was used for less than one-half of one per cent of the distance.

Application of Carrier Telephone Systems

A major improvement in the transcontinental service came in 1926 with the placing in operation of carrier telephone channels between Chicago and Sacramento, Calif. These carrier systems resulted in large savings in the cost of telephone circuits, as by their use three additional circuits could be obtained from each pair of wires which had been suitably arranged for this purpose. Their use also made it possible to improve still further the clearness of transmission. As a matter of interest, sections of the original eight-gauge group of four wires which are still in use and which at first provided three telephone circuits, now provide nine circuits.

The carrier channels between Chicago and Sacramento were connected to four-wire cable circuit facilities between Chicago and New York and between Sacramento and San Francisco and gave a circuit which transmitted a frequency band about 2200 cycles wide. Added improvements in the carrier systems during the following years permitted greater circuit stability and better transmission and increased the reliability of service.

Requirements for service over all of the routes, described above, have grown until today there are more than 100 through telephone circuits across the western states which are available for transcontinental service. Nearly two-thirds of these circuits are provided by carrier telephone systems.

Of course, a great many of the calls which pass over these

lines do not cover the complete distance across the continent, but there are established at present about 400 connections, involving over 800 persons, each business day between points on the Atlantic seaboard and points in the Pacific coast states. In addition, such radiotelephone connections as those from the eastern states to Hawaii, Japan, Java, and the Philippines and from the western states to Europe, South America, and Central America cross the country on these wires. Some of the telephone circuits are also used as parts of nation-wide networks specially provided for the transmission of music and speech for broadcast purposes, for transmission of photographs by wire, and for the operation of voice-frequency carrier telegraph systems, each of which provides twelve telegraph circuits.

Telegraph Development

The original transcontinental group provided only four telegraph circuits and these were operated over the same wires simultaneously with the telephone circuits. Although additional telegraph facilities of this kind have been obtained as open wire circuits were constructed to meet the telephone requirements, it was impracticable in this way to meet all of the demands for telegraph service. Furthermore, the increasing speed and other requirements of the improved telegraph services were calling for higher grade facilities. To meet this demand, high-frequency carrier telegraph systems were installed, each of which provided the possibility of obtaining ten high grade through telegraph circuits on a pair of open wires over which telephone service was operated simultaneously. By 1923, telegraph circuits of this type had been made available between Chicago and San Francisco. Today there are fifty through transcontinental telegraph circuit facilities provided in this manner in the area west of Chicago. These have been supplemented by voice-frequency telegraph systems, of

which there are now six in service, providing seventy-two through telegraph possibilities.

Improvements in Circuit Layout and Operating Methods

When the first transcontinental circuits were placed in service, no direct circuit from Chicago or New York to San Francisco was set up because the number of calls did not justify it. It was necessary, when New York wished to reach San Francisco, for the connection to be switched at Chicago, Omaha, Denver, and Salt Lake City. Another factor which made it undesirable to operate a direct transcontinental circuit initially was the fact that no method was then available which would pass signaling currents around or through the telephone repeaters.

An important step toward improved service through better operating methods came on July 12, 1917, when, on account of increasing traffic and the availability of new developments, it became practicable to establish the first direct Chicago-San Francisco circuit, thus making unnecessary the switching connections at Omaha, Denver, and Salt Lake City. This direct telephone circuit was the longest in the country until December 22, 1923, when, with the opening of the southern transcontinental line, a Chicago-Los Angeles circuit was established, making a switch at San Francisco unnecessary. The first direct transcontinental circuits were placed in service in the permanent layout on December 21, 1927, when two New York-Los Angeles circuits were set up. These circuits were followed the next year by two New York-San Francisco circuits. This development toward direct circuits has been continued and has resulted in steadily improved speed with which customers are connected with those whom they are calling. The speed of service in the early years of transcontinental service was very poor compared with present day standards and it was

necessary for a customer to wait a long time after he had filed a call before the connection could be established. As late as 1926, the average day speed of service on much of this traffic was about twenty-five minutes. Today the average time required to complete connections under most conditions is about two minutes.

The provision of lines and the operation of service across such long sections of the country brings to the forefront the necessity of day-to-day coördination of effort, if the best results are to be obtained. On many connections, the circuits must cross twelve to fifteen states and the conditions to be met are naturally subject to considerable variation. Furthermore, the interconnection of the various lines provides means for alternate routings at times of interruptions. In short, the country-wide network of long lines is handled as one system and the messages "go through" if there is any possible way of establishing the connection.

Summary

A summary of the changes and continuous improvements in transcontinental telephone facilities and service in the first two decades of its operation is really a summary of progress in many phases of long distance telephone service in this country during the same period.

Vacuum tube telephone repeaters used at three points on the transcontinental circuits were quickly applied to other lines until now we find over 100,000 installed throughout the country. Carrier current systems used so effectively on these long routes to increase the number of circuits that can be obtained from one pair of wires are also in general use. The substitution of cables for open wire along substantial parts of the transcontinental routes is an example of what has been done on a large scale in other sections. These items have contributed in large measure to clearer transmission and large savings in cost. The time required to complete connections has been

steadily reduced, and rates have been lowered over the period so that the rate for a three-minute daytime New York-San Francisco station-to-station message, which was $16.50 in 1919, is now $9.00.

These evolutionary changes have all been in the direction of providing better transcontinental service at a lower cost to the public; and that these accomplishments have been of increasing value to the public is evidenced by the large increase in business handled.

J. J. PILLIOD

The Changing Years as Seen from the Switchboard

Editor's Note:

The interviews appearing under the above title in current employee magazines of the Bell System are reprinted here as affording an interesting supplement to "Opportunities for Women in the Bell System" which was published in the BELL TELEPHONE QUARTERLY *for January, 1932. Previous installments have appeared in the last three issues of the* QUARTERLY.

7. PERSONALIZED SERVICE AND PUBLIC RELATIONS

No one knows better than do telephone people what is meant by the words "personalized service" and "good public relations." No one knows better than they that, as applied to the telephone business, the two terms mean essentially the same thing.

The maintaining of good public relations means the making of satisfactory human contacts and this, in turn, means the personalization of the service. The personalization of the service means that each telephone employee makes it clear to every subscriber or other telephone user that, in common with every other telephone man and woman, he or she stands ready at all times to do his or her part in providing for the customer, as an individual, a service that is not only as nearly perfect technically as possible, but that is as pleasing as possible to the telephone user.

This is true whether the individual employee concerned is a plant man installing a telephone or repairing it at the subscriber's office or home, trimming trees along a highway or driving a truck upon it; a public pay station attendant; or a man or woman at a business office counter or desk. It is, in a sense, particularly true of the operator, for her contacts with the public, made over the telephone, are peculiarly intimate

and personal. These contacts, moreover, are far more numerous than all other contacts between telephone employees and the public they serve, their total running to more than 40,000,000 a day.

One cannot review the part which the woman at the switchboard has played in the development of telephone service, as the writer and his readers have been doing in the present series of interviews based on the experiences of early telephone operators, without becoming profoundly convinced that the idea expressed by the phrases "a personalized service" and "good public relations" is not a new idea.

As has been pointed out in the present series, and many times elsewhere, the development of telephone service in America has been a process of evolution. What has been true of the service as a whole has been equally true of the idea of creating good public relations through the personalization of the service. This fact becomes convincingly apparent as one studies the reminiscences of the several hundred early telephone operators upon which the present series of interviews is based. Some of these stories of pioneer telephone women express this idea by inference, in the picture they paint of their life at the switchboard. Some of them are much more explicit.

Miss Frances Oberbeck, who began her telephone work as an operator in St. Louis, Mo., in 1883, writes of her early experiences in words which clearly show that the spirit of the telephone operator was then exactly what it is today. She says:

> In the early days there was little or no actual supervision in the central office. Rather, there was a general understanding that everyone was to do her best. We were all intensely loyal to the company. . . . Of course, we did not realize that we were pioneers in a great business, but we could understand that our work was most fascinating, and that the central office was the embodiment of everything that was wonderful. Because of these things we strove to improve our work ourselves, without supervision. I believe that attempts to personalize the service began in those early days

when a good manner and a soothing voice were our only protection against irate and profane customers who had become accustomed to swearing both at and with the boy operators.

Miss Oberbeck adds that the relations between the operators and most of their customers were very friendly and that the girls at the switchboard knew most of their subscribers by name and took pride in recognizing their voices. "It was not uncommon," she adds, "for an operator to spend much of her spare time studying the telephone directory so that she could memorize the numbers of subscribers, for in those days most of our calls were given by name only."

The recorded reminiscences of other early operators present an even more graphic picture of the informal relationship that existed between the women in the central offices and the public they served. Even in the larger cities, this relationship was not unlike that which exists in many small communities today, or that which is quite likely to be characteristic of the operation of a private branch exchange in a typical business concern. If anything, the voice contacts between the operator and the telephone user during that early period were more informal than those which will be found at any switchboard today, whether public or private.

Paging Bill Smith

When an operator answered a subscriber's signal, she was quite likely to hear something like: "Hello, Annie, give me Bill Smith—he's probably up at his lumber yard, but if you don't find him there, maybe he's gone home for dinner." And Annie—or it might have been Mary, or Louise, or Norah—got Mr. Smith.

In those early days, as far as the handling of traffic was concerned, telephone service was a service which personalized itself. So thoroughly was it personalized, as a matter of fact, that some subscribers fell into the habit of asking the operators, informally and as personal favors, to perform services which to-

day would be classified as far outside the scope of telephone service.

"A subscriber," writes Mrs. Catharine Moore, of her experiences as an operator in Chicago, which began in 1884, "would request us to awake him with a call at a certain time in the morning. Upon leaving his office, he would request us to make a note of the calls coming in for him during the next hour, as he was leaving the office and would return at the end of that time; or, if he were going home and someone was anxious to reach him, the call was put through to his residence."

Almost numberless are the instances, cited by these pioneer operators, which give evidence of the informality of the relations existing between the women at the switchboard and their customers. Not infrequently a housewife would call her favorite operator to say that she was about to take a nap and wished to be called at three o'clock or some other specified time. So trustworthy did the telephone prove as a substitute for a clock that now and then a woman subscriber would announce over the wire that she was putting a cake into the oven and ask that she be called in three-quarters of an hour, and reminded to take it out.

Some Unusual Services

But the telephone sometimes substituted for a nursemaid, as well as performing the functions of a chronometer. Mothers who wished to go out for afternoon tea or a meeting of the "Dorcas Society" would leave their babies near the telephone with the receiver off, optimistically hoping that if the infant awoke from its nap during their absence, it would cry and the operator, hearing its wails, would call up the mother at the scene of the festivities and tell her to go home and care for the youngster.

One pioneer operator reports that it was not at all unusual to receive a signal from a customer and, on answering it, to hear

a customer say: "Mary, please see if you can find Charles and have him bring home some hamburger steak for dinner."

So well did some of the operators know the telephone habits of their customers, that grocers, bankers and newspaper men, who had long lists of regular daily calls, often had only to make the initial call and the next person on the list was found waiting on the line as each call was completed, until all of them had been called.

In many central offices during those pioneer days, the operators provided what amounted to a news service. Not only did they furnish information in regard to fires, elections, sporting events and so on when requested to do so, but in many cases they voluntarily called their subscribers and informed them of any important news that "broke" unexpectedly.

"Once," remarks an operator from Iowa, commenting on an obvious disadvantage of this system of news dissemination, "we received the news that Queen Victoria was dead and another time that President Cleveland had been shot and the information was spread over the community by telephone. Both of these reports were false rumors."

One operator reports a practice which, although it does not appear to have been widespread, had at least great possibilities. She does not explain in detail how this rather unusual service was provided for, but confides that some of her customers had, at times, "visitors who simply did not know when to go unless the telephone rang," and hints that the visitations of these boresome folk were sometimes cut short by prearranged calls from obliging operators.

Public Appreciation

Even when the services performed by the operator did not extend to any of the rather striking and unusual activities here described, they met with warm appreciation on the part of the telephone public. As is still the custom of some subscribers in the smaller towns and some who are extensive users of long

distance service or of particular public pay stations, many telephone users expressed this appreciation in tangible form. At Christmas time there came a flood of gifts from customers who wished to show their gratitude to the central office force, or to particular operators. Boxes of candy, bottles of perfume, flowers, gloves, handkerchiefs, groceries and even turkeys were among the more common gifts. One enthusiastic plantation owner in Louisiana called up his operator and announced that he was going to send her a barrel of sugar as a reward for giving good service. She gently but firmly declined the offer, with thanks.

Commenting on this method of showing appreciation for good service, Miss Emma J. Grady, of Old Point Comfort, Va., says:

> As the forces increased, this practice gradually died out. In the old days it was done in the nicest possible spirit. In some of the offices located in the apple-growing sections of Virginia a barrel of choice apples was always to be found in a corner of the building where they would be kept firm and cool. On market days the farmers' wives brought in delicious apple pies to the girls who answered the rural line calls.
>
> The most unique Christmas gift I can recall was at Staunton, Va. Answering a rap at the operating room door, it was opened to reveal, standing without, a young colored man in an immaculate white coat bearing a tray on which stood a large cut-glass bowl of egg-nog. The bowl was surrounded by small glasses, and twigs of bright holly were massed around the whole.

Miss Grady circumspectly adds that a consultation was held to decide what was to be done with the gift, and it was agreed that each operator would "take a wee bit when relieved for the day." So slowly did the supply of egg-nog decrease that it was decided to send the balance down to the Plant men. After that the decrease seems to have been accelerated.

Romance at the Switchboard

Not all of the rewards of this personal relationship between the operators and their customers were of a material nature.

Sometimes they took a form that was essentially emotional. What a deal of romance, for example, is wrapped up in the remark of a pioneer telephone woman from Ohio to the effect that "some of the operators were fortunate enough to win husbands through knowing their subscribers."

It seems a far cry from the telephone service of half a century ago, let us say, to the telephone service of today. Even in the smaller towns, an operator who "wins a husband" as a result of a romance begun over the wire is relatively rare. Strictly off the record, one may hazard the guess that, in most cases, a man who becomes the husband of a telephone girl must himself do the winning, and considers himself lucky if he succeeds in doing so.

In the larger communities, subscribers no longer express their appreciation of good service by presenting the operators with barrels of apples, bowls of egg-nog or proposals of marriage. Yet the public is not unappreciative, as the files of any telephone company will testify. Hardly a day passes without a letter from a telephone user who wishes to go on record in commending some operator, whom he does not know and probably never will, because she has given him the kind of service he has particularly needed.

"Times change," runs an old proverb, "and we change with them." Like most proverbs, it states a truth to which there are important exceptions. Telephone service has, indeed, changed during the past half-century, and in few respects more importantly than in the manner in which, in many localities, calls are handled at the central office. But the essential needs of the public for telephone service have not changed—they have merely increased and become more intense. The response of telephone people to these needs, in many communities, has changed in the manner in which it is expressed, but nowhere has it changed in the spirit which underlies it.

Indeed, the very changes in methods of handling telephone

traffic have been brought about by the necessity of meeting the changing needs of the communities and the individuals served.

Part of Telephone's Evolution

"Present operating practices, and the present relation between the operator and the telephone user, have come about gradually," said M. B. French, Traffic Engineer, Department of Operation and Engineering, American Telephone and Telegraph Company, when the writer called upon him for comment on this phase of telephone development. "Both are part of the evolution," he continued, "that has taken place in the telephone business as a whole. Changes have come as a result of changing conditions, and have been different in degree and nature in places of different size.

"In thousands of small communities, where there are relatively few telephones and where operating is relatively simple, there has been little or no change in the relation existing between operators and subscribers. There is still the same high degree of mutual understanding that formerly existed everywhere, even in the larger centers. This is a condition which the Bell System encourages, as it not only meets the service needs technically, but apparently meets them in a way that the public likes.

"In the larger places, however—and gradually in smaller places as they grow larger—the mere size of the list of subscribers, on the one hand, and of the operating force, on the other, make it practically impossible to render the same kind of personal service that can be rendered in small towns, where the operators are quite apt to be acquainted with the subscribers' names and numbers, their whereabouts and their personal service needs."

"But do you not think," Mr. French was asked, "that, although it is impractical and often impossible, as you say, to provide the same kind of personal service in the larger towns as

in the smaller ones, the service may still be called a personal service, although it is handled somewhat more formally?"

As Communities Grow

"Yes," answered Mr. French, "for the reason that the essence of a personal service is a kind of service that each subscriber will consider satisfactory to him personally. In the larger communities, the surest way of making the service satisfactory to each subscriber or telephone user is to keep the service as a whole up to a very high level. Increased complexity in the characteristics of telephone traffic, and in the equipment and operating arrangements required for handling traffic, makes it necessary to introduce more formality into the handling of calls. The more technical aspects of operation and service assume greater importance. Satisfactory high grade service becomes dependent on the use of carefully prepared operating routines and on effective supervisory attention."

Mr. French digressed for a moment to point out that this change in the nature of service in the larger communities is not peculiar to the telephone business, but is found in all industries. In such places, he remarked, the clerks in shops, agents at the railroad stations and taxicab drivers are not, generally speaking, known by their first names, as they are in many smaller towns, or even by their last names. There is, as Mr. French said, a tendency on the part of the public to look upon these employees more or less as impersonal representatives of the industry in which they are engaged, and to judge the service, which they provide, on a less personal basis than in the smaller towns.

"However, even in the larger places," Mr. French continued, resuming his discussion of telephone service, as such, "operating practices are designed with due regard to the importance of the personal attention factor in telephone service. A majority of calls, both local and toll, involve little in the way of unusual occurrence. On these calls it appears that the controlling serv-

ice consideration is prompt, accurate handling; there is no need for comment or questioning on the part of the operators. The major requirement, from the viewpoint of personal attention, is that the operators evidence an attentive and pleasing attitude.

When Something Unusual Happens

"Larger opportunities for personal attention to subscribers' needs occur on calls which are unusual in themselves or on which something unusual happens. Such opportunities exist on the small percentage of calls on which there are errors, irregularities or delays. They exist in connection with requests for telephone numbers and requests for charges on toll calls. Of course they exist on calls placed in emergencies—fire or other disasters, accidents and burglaries. They exist on long distance calls, especially those on which there is difficulty in locating the particular person with whom conversation is desired. Other opportunities occur when subscribers speak to the operators about service troubles, either relating to the operating or to their telephone apparatus.

"On calls of this type, good service may depend largely on a high degree of personal interest and possibly special action on the part of the operator. The effort is made, through carefully developed practices and through day-to-day supervision, to impress the subscribers with the fact that the operators give them competent, effective and undivided attention until they have satisfactorily disposed of each call.

As to the Dial System

"The introduction of the dial system has had an interesting effect on work of this kind. The large majority of calls, already referred to as involving little in the way of unusual occurrence and a minimum of opportunity for personalized attention, are dialed directly by the subscriber and handled through the machine. This allows concentration on the manual boards, provided for the purpose of supplementing the dial op-

eration, of those calls on which there is the greatest opportunity for personalized attention and for service betterment. This concentration in itself tends to facilitate the satisfactory handling of these calls."

The process of development, or of evolution, which Mr. French describes, has resulted in what might seem to be a paradox: the de-personalization of telephone service, from the standpoint of the individual operator's acquaintance with the individual subscriber, has led to a service that, in the overall sense, is more personal than ever before. For the very reason that the operator does not know subscribers personally, she treats them all as if she were at their personal service. Just because she cannot, in a vast majority of cases, know how important a particular call may be, she handles every call as if it were urgent—as courteously, as promptly and as accurately as she knows how. That is her part in carrying out the Bell System's pledge of providing in this country "the most telephone service and the best, at the least cost to the public."

8. A Spiritual Principle

Behind the telephone there lies not only a physical principle, but a spiritual principle as well. This spiritual principle has found many forms of expression. When telephone employees seek words with which to give it form, they say: "The message must go through!" When representatives of the management of the organization which provides telephone service would express this principle, they use some such words as those of President Walter S. Gifford when, addressing a convention of the National Association of Railroad and Utilities Commissioners, a number of years ago, he said: "Our policy and purpose are the same as yours—the most telephone service and the best, at the least cost to the public." Whether expressed in the words of the employees or those of the management, this spiritual principle is essentially the same thing. It is directed toward the same unalterable objective of

providing at all times a telephone service that is responsive to the requirements of the public. Just as the telephone transmitter, the telephone current, and the telephone receiver are responsive to the vibrations of the human voice, so this spirit is responsive to human needs.

As human needs have increased, the spirit which has prompted telephone men and women to respond to these needs has broadened and deepened. In essence, it is the same spirit it was a half-century ago; in the manner of its expression, in the number of people among telephone employees whom it inspires, and the number of people among the telephone-using public who are affected by it, it has become a more potent force than, in the nature of things, it could have been during the first years of telephone history. This spiritual principle—let us call it "The Spirit of Service"—has been the product of growth. Generations of telephone workers, each in his own time and in his own way, have contributed to it. They have made it the potent force that it now is.

This series of articles has been based on reminiscences of men and women who, in the first years of telephone history, served at the switchboard and there played pioneer parts in the romance of telephone service. As the title of the series suggests, it is a view, in retrospect, of the changes wrought by the sixty years which have passed since Bell first demonstrated the truth of the physical principle of telephony. In these reminiscences, one might well expect to find written a record that would cast light on the growth of the Bell System tradition which has come to be called "The Spirit of Service."

Plain and Unadorned Accounts

This record is, indeed, written in these personal recollections of the women—and the boys for that matter—who served at the switchboard during the pioneer days. But one has to search for it between the lines—these early operators are strangely reticent about discussing their own contributions to

the evolution of the spiritual principle that has played so important a part in telephone history. There is almost a complete absence of heroics in their plain and unadorned accounts of what they did and how they did it. They rarely tell of their own exploits. Now and then a woman writes of how, as a girl, she and her companions waded through drifts of snow to reach the central office, because they knew they would be needed. Here and there one finds references to some special case of sickness or accident which called for unusual resourcefulness on the part of those who served at the switchboard. But even such comparatively rare instances are recorded with a restraint which proves that these pioneer operators accepted an emergency, as operators do today, as merely another phase of their day-to-day job of giving the best service of which they were capable.

Three Operators' Reminiscences

"It is rather interesting," writes Miss E. Newell, of Stockton, Cal., "to note how the Spirit of Service was the keynote of our work as far back as 1897—'Give service, no matter what happens!' Everyone worked cheerfully any hours assigned, when the emergency arose. During the many floods common in those days, we worked twelve or fifteen hours. We took a great pride in giving good service under those difficult circumstances."

Over and over again, in these reminiscences of early operators, there is repeated, like a refrain, some expression of the satisfaction they feel in having had a part in the development of telephone service and of this spiritual principle that is built into its foundation.

"One impression which has remained with me," writes Miss Katherine Schmitt, who has been quoted in earlier interviews, "is the devotion of telephone employees to the company, to their work and to each other. Under the most trying circumstances, it steadfastly stands—just why, I do not know. An

elusive element—'the Spirit of Service'—grips each one of us."

So, also, writes Miss Elizabeth Harlle, who began her telephone career at Corsicana, Tex. just thirty years ago. Says she: "I have often wondered how an organization employing so many people could get such a number of interested and loyal employees. I am proud of my connection with them, proud of the patience they have had in my development and the confidence they have shown in my ability."

"Just why, I do not know," says the woman from New York. "I have often wondered," says the woman from Texas. Yet there is nothing mysterious about the devotion of telephone men and women to the service in which they are engaged. It is simply the response of human hearts and human hands to human needs.

Vail Medal Memorial Fund

Not infrequently, when this spirit of devotion to the interests of the public on the part of telephone operators has risen to unusual heights, it has been recognized by unusual rewards. The first gold medal ever awarded for "Noteworthy Public Service" from a fund created to honor the memory of the late Theodore N. Vail, twice president of the American Telephone and Telegraph Company, was given to a woman—Mrs. Mildred Lothrop. When the Omaha Creek overflowed its banks and swept through the streets of the little village of Homer, Neb., on the night of May 31, 1920, Mrs. Lothrop remained at her switchboard, telephoning subscribers in the path of the approaching flood and warning them to flee to places of safety. In imminent danger, she continued to send out her warning until the rushing waters covered the floor of her little office and, mounting steadily, washed over the shelf of the switchboard, putting the wires out of service. Only after further service had become impossible did she seek her own safety, when she had to wade through water breast-high in order to escape from the rapidly rising flood.

The medals provided from the Theodore N. Vail Memorial Fund are not presented to Bell Telephone company employees alone, but also to other telephone men and women whose acts merit recognition as being of "Noteworthy Public Service." Such was Miss Gladys I. Gibson, a private branch exchange operator and heroine of a disastrous fire which occurred at a mid-western medical institution in 1929. Two minutes after the blaze broke out, an operator at the central office, upon answering a call, heard a voice crying: "There's a fire here at the hospital—a terrible explosion—call the fire department, the police, ambulances—it's awful—and—"

The voice, afterward identified as that of Miss Gibson, ceased abruptly. Choking and gasping for breath as the fumes from the fire surrounded her, she had sounded a warning which beyond doubt prevented the loss of life in the disaster from mounting still higher. She gave her life for the lives of others. The gold Vail medal awarded in recognition of her heroism was the only national award ever granted posthumously.

Although the establishment of the Vail Memorial Fund afforded a new form of recognition for such acts of "Noteworthy Public Service," the spirit of devotion for which they were awarded was by no means new. The records of the first decades of telephone history are incomplete in this respect, as they are in many others, but there is in them enough to make it abundantly clear that in those days of small beginnings, as at present, emergencies arose which called for an unusual degree of resourcefulness, initiative and devotion to the service on the part of telephone operators. Human needs existed, then as now. Then, as now, human hearts and hands responded to them.

The Story of Sally Rooke

There are stories of devoted heroism which time has not obscured, nor will, so long as deeds of courage continue to thrill the hearts of men. One of these epics of telephone history has

its setting in the little New Mexican village of Folsom—a ranch-country town on the banks of a stream called the Dry Cimarron. The time is the night of August 27, 1908—twenty-seven years ago.

In her cottage on the main street of Folsom, Mrs. Sarah J. (Sally) Rooke, sixty-eight years of age, was attending the switchboard of the local telephone exchange. During the evening, rain had begun to fall throughout the Dry Cimarron Valley. Gradually the waters of the creek had risen, but this had happened before, and there was no apprehension of danger. About ten o'clock, however, Mrs. Rooke received a call from a ranch house ten miles up the valley, which at that point narrows to form a canyon, informing her that a cloudburst had occurred and that a tremendous volume of water was rushing down the river.

Sensing the danger, Mrs. Rooke began calling ranch houses known to be in the path of the advancing flood, above the village; then the subscribers in Folsom itself; then those farther down the valley. Repeatedly she refused to leave her post, explaining that she must warn other ranchers still farther down the Cimarron.

The flood struck. Buildings were shattered, torn from their foundations and borne like chips upon the surface of the raging wall of water which raced down the valley. Amid the wreckage of the little building which was to her both home and post of duty, this gray-haired heroine of the switchboard was swept away to her death. Seven months later, on a ranch eight miles below the village, half-buried beneath the debris which the flood had deposited far above the stream's normal banks, her body was found.

Today there stands over her resting place a granite monument, erected from funds contributed by more than 4,000 donors, most of whom were telephone employees. It bears the inscription: "With heroic devotion she glorified her calling by sacrificing her own life that others might live."

"Soldiers of the Switchboard"

One of the stirring tributes to duty well performed during the World War was that which General Pershing paid to the women telephone operators who served with him in France. Perhaps it was the highest honor ever accorded to the women of the switchboard—except that which General Pershing had paid, early in the war, when he insisted that the operators who were to serve overseas must be women.

Writing later of this important phase of his experiences in the war, General Pershing said:

> One of the crying needs when we once began to use our own lines was for experienced operators.
>
> Instead of trying to train men of the Signal Corps, I requested that a number of experienced telephone girls who could speak French be sent over, and eventually we had about 200 girls on duty. Some doubt existed among members of the staff as to the wisdom of this step, but it soon vanished as the increased efficiency of our telephone system became apparent.
>
> No civil telephone service that ever came under my observation excelled the perfection of our system after it was well established. The telephone girls of the A.E.F. took great pains and pride in their work and did it with satisfaction to all.

These "soldiers of the switchboard" had been selected from thousands of young women who had volunteered for service, and were thus representative of their sister operators. This well earned tribute to their devotion was more than a personal tribute to them, individually or as a group. It was a tribute, rather, to the American telephone operator, past, present and future. For the spirit which inspired these young women who served in France was the spirit which inspires every telephone operator, always,—the spiritual principle which prompts them to respond to human needs.

Out of the Doing of Daily Duties

Wartime patriotic fervor alone cannot explain this spirit. Nor can it be explained by the inspiration that comes from

being faced with emergencies which must be met. Rather, it arises from an unconscious habit of mind that grows out of the doing of daily duties, many of which must often appear humdrum and prosaic, as if they were being done under extraordinary or inspiring circumstances. A telephone operator never knows—and in a vast majority of cases never will find out—what issues of life or death may hang upon the promptness with which she answers "Number, please" in response to a signal at her switchboard, or upon the swiftness and sureness with which she establishes a desired connection. All that she knows is that, be it great or small, there is a human need behind each signal, and that it is her calling—the calling "glorified" by Sally Rooke and thousands of others—to respond to this need.

What we have here chosen to call the spiritual principle is the foundation of telephone service. That no one knows this better than the Bell System's chief spokesman, the President of the American Telephone and Telegraph Company, Mr. Walter S. Gifford, is shown by his constant tribute to the System's personnel. "The greatest asset of the System," he once said, "is the skill, energy, and character of the men and women who make up its organization." And in reporting to the stockholders last March the operations for the preceding year, he concluded his summary with this significant paragraph:

> "The message must get through." There is embodied in those words an ideal ever present in the minds of telephone men and women. Fifty-nine million messages a day "got through" in 1934, and service standards were the highest on record. This achievement evidences the skill and enthusiasm of the quarter of a million men and women of the Bell System who are devoted to an essential public service, in which over-all success is so dependent on the efforts of each individual.

And with this sentiment, that epitomizes the philosophy of the Bell System, is closed the series of chapters that review "The Changing Years as seen from a Switchboard."

R. T. BARRETT

Changes in Birth and Death Rates as Affecting Population Growth

POPULATION growth in the United States since 1930 has been very largely due to the excess of births over deaths and in view of the probable continuation, for an indefinite period, of present restrictions on the admission of aliens, it seems reasonable to assume that future gains will depend almost entirely upon the natural increase of the population. Growth from this source, however, has been declining very rapidly in recent years; a drastic drop in the birth rate alone accounts for this decline and the downward trend of the birth rate shows hardly any tendency as yet to slacken. Furthermore, the expectation of a gradual rise in the mortality rate before many years introduces the prospect of at least a temporary period of very nominal population growth in the not far distant future.

In a country where the business community has grown up largely under conditions of an uninterrupted increase in population and rapidly expanding markets, some adjustment of established conceptions of future production and consumption may be necessary to conform with the reality of a declining rate of population growth. The growth of the telephone industry, however, does not depend so much upon mere numbers as upon the qualitative characteristics of the population, and if an improved standard of living accompanies the retardation in rate of population growth, then the increased volume of business due to a greater penetration of the potential market for telephone service might readily more than offset the effect of a numerical decline. In any event, a thorough knowledge of recent and prospective changes in population growth is im-

portant to those responsible for engineering plans, commercial programs, and general market studies.

Vital Statistics: Historical Background and Accuracy of Registration

The vital statistics of many American states and cities have been collected for several decades, but the beginning of Federal coöperation in developing a national and systematic plan for the recording of such statistics dates back only to 1902, when Congress passed the act establishing a permanent census office which contained a section providing for "the annual collection of statistics of births and deaths in registration areas for the year 1902 and annually thereafter." The act limited the collection of such statistics to those states which possessed "registration records affording satisfactory data in necessary detail."

Following the passage of this act, the Bureau of the Census with the coöperation of the American Public Health Association drafted an outline for a standard or model state law for the registration of deaths, and began a campaign which had for its goal the extension of the registration area to cover all states. After a state legislature had enacted an acceptable law, and the registration machinery therein provided for was set up and put into operation, the Director of the Census regularly made tests to determine whether the registration of deaths was complete, or sufficiently so for statistical purposes. If it was, the state was admitted to the registration area.

In 1902 there were only ten states and the District of Columbia that met the Federal requirements for the registration of deaths. (The recorded death statistics for these states date back to 1900.) However, additional states gradually qualified for admission until in 1933 every state was included in the death registration area. This means that the machinery is now in operation for registering every death in the United States as it occurs and for recording the disease, accident, or

violence that caused the death; also the age, sex, occupation, and nativity of the decedent. A birth registration area was similarly established in 1915 and steadily expanded until in 1933 every state was included. Thus, for the first time in our history the birth and death registration areas are now complete for the entire United States. The availibility of birth and death statistics on a national basis is important, as these data not only measure the natural increase of the population of the country but, when combined with immigration figures, also indicate approximately the total population growth.

Under the best of registration systems some deaths, especially those of very young infants, escape registration; but few deaths, if any, are registered more than once. As a result, the number of deaths registered is somewhat less than the true number. Omissions are probably most common in states which have recently been admitted to the registration area and in rural districts, especially those that are very sparsely settled. Perhaps registration requires for its effective administration a certain minimum density of population. In most states the records are improving, and this tendency toward improvement will doubtless continue now that the effectiveness of the system can no longer be adversely affected by the admission to the registration area of new states with less complete records.

A Federal census is more likely to understate than to overstate the population because omissions are more common than false returns or double entries, but a census is probably nearer the truth than American registration of births or deaths. If that is so, the accuracy of birth registration can be roughly checked by comparing the births registered in the 12 months preceding the date of a decennial census with the number of children reported by the census as being under one year of age. This test indicates that births were not so well registered in 1930 as in 1920, probably because the rapid extension of the birth registration area was attended by a deterioration in the

over-all efficiency of registration. However, of the 36 states which in 1930 showed varying degrees of deficiency in birth registration, 21 had joined the registration area since 1920, and 11 of the others had displayed substantial improvement over their 1920 record. This development suggests that birth registration in the United States is tending to become increasingly efficient.

The Mortality Rate

The American death rate over a series of years is unknown, but there are two approximate measures of it. One measure is the death rate of the d.r.s. 1900[1] for each year between 1900 and 1934; the other is the death rate of the d.r.a.[1] over the same period. The former has the advantage of covering a constant area in which relatively few deaths were unreported; it has the disadvantage of not including any state south of the Potomac or west of the Mississippi, and so is not representative of the whole country.

The death rate in the d.r.s. 1900 was 17.2 per 1,000 in 1900 and 11.0 in 1934, while the rate in the expanding registration area was 17.6 in 1900 and 11.0 in 1934. The death rate of the United States as a whole in 1900 was evidently not far from 18 per 1,000, so the rate has fallen by about 40 per cent since the beginning of the century. It is conservatively estimated that not fewer than 4,000,000 lives have been prolonged since 1900 by the fall in the death rate.

This remarkable improvement in mortality experience reflects the tremendous progress of medical science in combating disease and in prolonging life. The most important achieve-

[1] The area from which statistics of deaths are received and which expanded between 1900, when the record began, and the present time is known as the death registration area, or d.r.a. The District of Columbia and the states included within this registration area, but excluding registration cities outside of the registration states, are called collectively the death registration states, or d.r.s. To make the meaning certain, the phrase must be followed by the year for which the figures speak; thus d.r.s 1900 means the 10 states and the District of Columbia which comprised the death registration states in 1900.

ment in the crusade against disease and death has been the great reduction in infant mortality, primarily due to increasing control of the so-called "common" diseases of childhood—measles, scarlet fever, whooping cough and diphtheria—illnesses once thought inevitable. The annual average ratio of infant deaths per 1,000 live births in the registration area declined from 97 in the 1915–19 period to about 60 in the 1930–34 period.

There is no conclusive evidence that human life at its best extends through more years than it did in former generations. But if the average lifetime is lengthened, even though the maximum is not, the duration of group life is prolonged. In the United States life expectancy at birth has increased very materially during the past several decades until at present the figure is about 60 years, and it is believed that the ultimate limit in extending the average span of life has not yet been reached.

The ages of persons dying are published for 5-year age periods, but because of the numerous deaths at the threshold of life the first group is broken into two parts: children under one, and children one to four years of age. As shown in the first two columns of Table 1, in 1900 the deaths under one year of age in d.r.s. 1900 were more than one-fifth, while in 1930 they were less than one-tenth, of the entire number of deaths at all ages. Deaths under 10 years of age in 1900 were about one-third, but in 1930 were little more than one-eighth of the total; deaths over 60 years of age in 1900 were three-tenths, but in 1930 were nearly one-half of the entire number. In fact, the proportion of deaths in each age period under 40 was lower in 1930 than in 1900 and higher for all age groups above 40. These changes reflect the aging of the general population from a median age of nearly 23 in 1900 to between 26 and 27 in 1930; they also reflect the improvement in the medical care of young people during this period.

There is need of studying not only the age distribution of deaths, but also death rates by age, that is, the average number of persons dying annually at a specified age among each 1,000 persons living at that age. The most marked fall in the death rate between 1900 and 1930 was at ages one to four; the 1930

TABLE 1

PER CENT DISTRIBUTION OF DEATHS AND DEATH RATES BY AGE GROUPS IN D.R.S. 1900: 1900 AND 1930

Age in Years	Per Cent Distribution of Deaths		Deaths per 1,000 Population	
	1900	1930	1900	1930
Under 1	20.79	9.27	162.17	68.07
1–4	9.48	2.84	19.80	4.84
5–9	2.70	1.54	4.65	1.93
10–14	1.59	1.11	2.98	1.42
15–19	2.56	1.77	4.84	2.35
20–24	3.80	2.46	6.81	3.28
25–29	4.25	2.65	7.89	3.68
30–34	4.09	3.01	8.57	4.32
35–39	4.19	3.80	9.70	5.38
40–44	4.02	4.49	10.98	7.31
45–49	3.92	5.42	13.20	10.26
50–54	4.35	6.54	17.01	14.58
55–59	4.71	7.46	23.45	20.88
60–64	5.26	9.02	31.91	30.96
65–69	5.72	9.67	47.12	45.02
70–74	5.89	9.89	69.79	66.97
75–79	5.40	8.42	104.79	102.25
80 and over	7.28	10.64	337.20	322.00
All ages	100.00	100.00	17.16	11.52

rate at these ages was only about one-fourth of the 1900 rate. The last two columns in Table 1 show that the healthiest period of life as measured by the death rate is 10 to 14 years of age, while the least healthy periods are early infancy and the years beyond fourscore. As a result of the changes indicated in this table, the average length of human life and the years

of life resulting from a unit number of births have increased. This increase is one statistical measure of human progress.

The influence of age upon the death rate is so great that it tends to overshadow the effect of other factors, such as the sex, marital, and nativity composition of the population, and its distribution between urban and rural areas. Variations in the death rate might be better understood if the significance of these minor influences were considered briefly.

The male deaths reported in d.r.s. 1930 outnumbered the female deaths by more than 125,000. But as the estimated number of males in those states exceeded the females by nearly 1,400,000, the larger number of male deaths might be ascribed to the excess of males in the population. Male deaths, however, were nearly 55 per cent of the total deaths, but males formed not quite 51 per cent of the population. Furthermore, only three-fourths of the states had more males than females in their population, but every state reported more male than female deaths. It seems clear, therefore, that the death rate of males was higher than that of females in 1930. And, finally, between 1900 and 1930 the death rate of males in d.r.s 1900 decreased less than that of females, so the difference between the two sexes in this respect increased during that period.

Another factor to be considered involves the effect of marriage upon the rate of mortality and raises the question: how does the death rate of groups of the same sex and age vary with marital condition? The only data available on this subject are for the d.r.s. 1924 covering the five years 1924 to 1928, but the conclusions are interesting and have considerable significance. Among young men 15 to 19 years of age the death rate of the single was less than that of the married, but at every age above 20 the death rate of husbands was below that of any other class, and at ages between 35 and 50 it was about one-half that of bachelors. This difference is due in large part to marital selection, as young husbands doubtless are healthier

on the average than men of the same age who do not marry, but probably a contributing factor is the beneficial influence of married life. On the face of the statistical records, marriage affects the death rate of women less than that of men. At ages under 35 wives have a higher death rate than single women, perhaps because the favorable effects of marital selection are more than offset by the dangers incident to child bearing. At all ages above 35 the married women enjoy a lower death rate than spinsters.

There is considerable variation in death rates between the native whites, the foreign-born whites, and the negroes. In 1930 the native whites had the lowest death rate (9.6), while the foreign-born whites were at the other extreme with 19. However, when allowance is made for the higher median age of the foreign-born—in 1930 it was 44 or 45 compared with 23 or 24 for the native white—then the differential in death rates largely disappears. The negro death rate was 16.5 and since the median age of the negro race was practically the same as for the native whites, the higher death rate must be explained by other causes, probably a generally lower standard of living combined with a greater susceptibility to certain diseases.

Since 1900 the urban death rate has fallen much more rapidly than the rural, but still exceeds the latter by an appreciable amount, probably by at least 10 per cent. The public health movement, which is supposed to have played a large part in reducing the death rate, has probably had more influence in cities than in the rest of the country. Another factor tending to lower the death rate in the cities faster than in the rural areas has been the heavy migration of youths and young adults from the country to the cities. In this connection there is probably some degree of validity to the theory of selectivity of migration from rural to urban areas which postulates that the stronger or healthier element among the rural youth tends to migrate to the cities in disproportionate num-

bers, while the weaker element tends more to remain in the country.

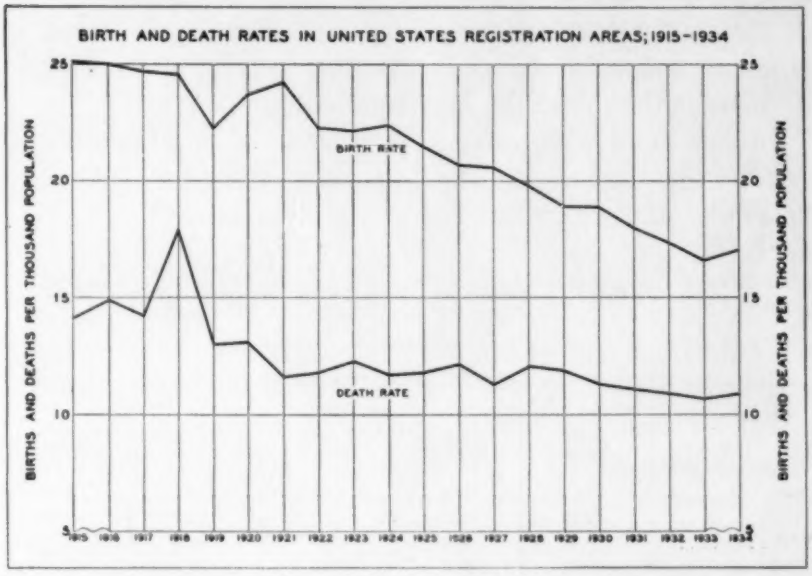
The gradual though steady decline in the over-all death rate during the past 20 years cannot continue much longer for several reasons. In the first place, it seems probable that the most rapid rate of contribution of medical science to disease prevention and improved health has been realized, especially in the case of children. Furthermore, the increase in the older age groups where the specific death rates are high (the number of persons over 65 years of age increased by 34 per cent between 1920 and 1930, whereas the number of children under five declined by one per cent) and the steady advance in the average age of the population will, if continued, inevitably result in a gradual reversal of the present downward trend in mortality.

Another reason for expecting an increase in the mortality rate is due to the fact that, in a situation where there is little or no excess of immigration or emigration, the current death rate of 11 per 1,000 implies an average span of life of over 90 years, whereas the present expectation is not far from 60 years, which is equivalent to a death rate of about 17. It should be quite apparent that the present low death rate is possible only because of the unevenness in the age distribution, which consists of a concentration of a disproportionate number of people in the middle age groups where the specific death rates are relatively low.

The Birth Rate

The birth rate in the United States has been declining very rapidly during the past twenty years from about 25 births per thousand of estimated population in 1915—when comparable statistics first became available—to 17.1 in 1934, a drop of nearly one-third, with the decline much more precipitous in the last ten years. The 1934 rate represents a gain of three per cent over 1933, which had the lowest birth rate ever re-

corded in this country. These changes in the over-all birth rate, as well as variations in the over-all death rate since 1915, are shown graphically in the accompanying chart.[2]


BIRTH AND DEATH RATES IN UNITED STATES REGISTRATION AREAS; 1915-1934
BIRTHS AND DEATHS PER THOUSAND POPULATION
BIRTH RATE
DEATH RATE
25
20
15
10
5
1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934

Under conditions of severe economic depression, the birth rate fell more rapidly than it probably would have declined under normal conditions and the slight tendency (in 1934) for births to increase represents a temporary and minor adjustment due principally to two factors, namely, (1) the sharp increase in the national marriage rate in the last two years, a reversal of the decline which set in following 1929, and (2) the strenuous campaign carried on during 1934 to attain more complete registration of births than was realized in other recent years.

The downward trend in the birth rate has been due to several causes, among which the most important is the increased

[2] These rates are for the steadily expanding registration areas, but it is believed they are sufficiently representative of the entire country in the early years to be reasonably comparable with the rates for the more recent years, when the great majority of the states were included.

knowledge of birth control and its growing practice among the masses. Other factors of less influence are the rapid urbanization of the population and the economic stress of unfavorable business conditions on married couples. Although some of these influences are temporary, nevertheless, the trend in economic and social change is operating in favor of a continued decrease in the size of the American family.

In default of birth rates from 1900 to 1914, a measure of fertility may be found in the proportion of children under five years of age to 1,000 married women of normal child-bearing ages.

Table 2 shows a drastic decline in the proportion of children

TABLE 2

CHILDREN UNDER 5 PER 1,000 MARRIED WOMEN 15 TO 45 YEARS OF AGE

Year	All Classes	All Whites	Native White	Foreign-Born White	Negro
1900.....	929	908	870	1,054	1,083
1910.....	844	837	810	934	895
1920.....	772	779	742	931	702
1930.....	642	633	638	603	654

to married women of child-bearing age for each decade since 1900. Since it is known that infant mortality decreased between 1900 and 1930, and that in consequence the proportion of children born who lived to be five years old was greater in 1930 than in 1900, it is evident that the birth rate fell more rapidly than the above ratios of children. Apparently the birth rate in 1930 was not more than two-thirds of what it was in 1900 and the decrease during the last decade was greater than in any preceding ten-year period. Although the recorded population increase between 1920 and 1930 was 17,000,000, the number of children under five years of age at the later date was less than at the earlier one.

Table 2 shows that the proportion of white children to all white married women 15 to 45 years of age declined by 30 per

cent from 1900 to 1930, while the corresponding ratio for the negro race declined by 40 per cent. But between 1920 and 1930, the proportion among whites fell three times as fast as that among negroes. This disproportionate fall in white fertility is probably connected with the decline of immigration since the World War.

The comparative fertility of foreign-born and of native whites is another problem upon which the proportion of children to married women throws light. But it encounters the difficulty of a large number of mixed marriages in respect of which the number of children with a native mother is unknown prior to 1930. According to the 1930 census, which reported this information for the first time, two-thirds of the children of mixed parentage had a native-white mother and this ratio was used in estimating the corresponding numbers at preceding censuses. The ratios shown in Table 2 imply that foreign-born wives were 21 per cent more fertile than native wives in 1900, while in 1930 the latter class had a fertility six per cent higher than the foreign-born. But the two groups of native-white and foreign-born white wives differ markedly in age composition, and these variations in age structure are much more important than other differences. Table 3 shows how widely the two groups differ in this respect.

TABLE 3

PERCENTAGE DISTRIBUTION OF NATIVE-WHITE AND FOREIGN-BORN WHITE WIVES 15 TO 45 YEARS OF AGE BY AGE GROUPS: 1900 AND 1930

Age Group	Native White		Foreign-Born White	
	1900	1930	1900	1930
15–19	4.4	4.2	1.8	0.7
20–24	17.8	16.9	11.8	6.9
25–29	22.8	21.3	20.4	16.2
30–34	20.9	21.0	23.6	21.9
35–44	34.2	36.6	42.4	54.3
15–44	100.0	100.0	100.0	100.0

Of the native wives 42.4 per cent, but of the foreign-born only 23.8 per cent, were less than 30 years of age in 1930. Since the fertility of women is greatest at about the age of 20 and decreases to a vanishing point at about the age of 50, this wide difference in the age structure of the two population groups must have affected the gross figures of comparative fertility. Moreover, according to the specific birth rates by age groups for these two nativity classes in the b.r.a. 1930, the fertility of foreign-born wives at each age period was distinctly higher than that of native wives, although the difference decreased as the age increased. Table 3 also indicates that the changes in the proportions by age groups for the foreign-born class between 1900 and 1930 were considerable, with the decline in the proportion under 30 years of age amounting to 30 per cent for the foreign-born, as against only six per cent for the native whites.

The influence of the differences in age composition of the two nativity classes in 1930, apart from all other factors, can be measured by assuming that each age group in each nativity had the same fertility rate as for all white wives, and by computing how many children on that assumption would have been born among 1,000 wives of each nativity class distributed to age groups, as shown in Table 3. The computed births among 1,000 native wives would have exceeded by 40 per cent those among 1,000 foreign-born wives, the wide difference being due solely to the variation in age structure of the two groups. It thus appears that for purposes of comparison the proportion of children to foreign-born wives in 1930 should be raised by 40 per cent from 603 to 844, a figure about one-third larger than the 638 children to 1,000 native white wives, as shown in Table 2.

The sharp decrease in immigration, the resultant rapid rise in the average age of the foreign-born by more than seven years between 1910 and 1930, and the fall in the birth rate

among the foreign-born of each age group (tending to bring this rate into line with that among the native whites of like age) have combined to reduce rapidly the proportion of white children born of foreign parents and to increase correspondingly the proportion born of native parents. In the b.r.a. 1932 the latter class amounted to 82 per cent of all white births, so it seems safe to conclude that fully five-sixths of the white children born in the United States are of native parentage on both sides. If to these be added one-half of those of mixed parentage, fully seven-eighths of the blood in the white children born in recent years is native.

The statistics show that the birth rate is lower and has declined faster in urban than in rural communities. Formerly families having four or five children were common even in the cities, but now the more common number of children is one or two. One reason for the reduction in cities is that the cost of raising children in the cities is usually two or three times higher than in the country. In American cities of over 100,000 population, there are now only about two-thirds enough births to maintain their populations permanently stationary without accessions from outside. In cities of 2,500 to 100,000, the corresponding deficit is put at 10 to 20 per cent. But in the rural non-farm population, there is about a 25 per cent surplus in births over deaths, and in the farm population nearly a 50 per cent excess. As long as immigration is rigidly restricted, the cities will depend upon gains from the farms and villages to prevent their population from declining.

The deficit of births in cities is found principally among the so-called middle and upper classes. Class differential fertility—too little reproduction by the upper classes and too much by the lower classes—has been a characteristic phenomenon of American life. In general, families of professional classes have five to 10 per cent fewer children than those of business men, business men about 25 per cent fewer than

skilled workmen, and skilled workmen 30 per cent fewer than unskilled laborers. The extent or degree of the differentials in fertility between occupational classes in this country has decreased somewhat in recent years, probably due to the increasing spread of birth control knowledge among population groups less fortunate socially and economically.

True Rate of Natural Increase

The rapid decline in the national birth rate has brought it down to a level hardly sufficient to maintain a stationary population with our present expectation of life, provided there is no gain through immigration. But even this low birth rate is considerably higher than it would be except for our very favorable age distribution. Although we are in the habit of taking the age composition of our population for granted as if it were fixed by natural law, actually the proportion of persons at the different ages of life is not fixed but is variable. In fact, the distribution prevailing at a particular time is an important influence in many situations in the economic and social life of a country.

During the past census decade, our population had a disproportionately large percentage of people at the reproductive ages. This condition resulted first from the very heavy immigration of 25 to 35 years ago. These aliens were predominately young people who either brought young children with them or bore children soon after their arrival, and most of these children are now in the child-bearing ages. There is also a second factor, namely, the high birth rates which prevailed among the native stock a generation ago. This fact likewise contributed to a larger proportion of people now 25 to 35 years old than would have resulted if the present birth rate had prevailed in the previous generation. Both the heavy immigration and the earlier high birth rates have had the effect of swelling the proportion of those in the middle registers of

life, and this in turn results in more births than the present fertility of the population would produce without the temporary circumstances of the concentration of lives at the young child-bearing ages.

With the passage of time this temporary bulge in the age distribution will tend to become smoothed out, and the population will then be entirely dependent upon the balance between the existing fertility and mortality unaided by any accidental irregularities in the age distribution. This change will inevitably be accompanied by a further decline in the number of births and an increase in the death rate. In fact, the age composition of the population in 1930 shows that as a nation we are moving toward a marked reduction in the proportion of young people and a corresponding increase in the percentage of old persons.

It has been reasonably well established that native whites and city dwellers have lower rates of natural increase than the other classes of population; and since we are tending toward a larger proportion of native white stock and of urban population, we may reasonably consider that these changes will contribute to a slower rate of growth, independent of other factors.

Implications of Reduced Population Growth

The United States is approaching, in view of the continually diminishing rate of population growth, a situation in which the population may for a while become relatively stationary. Important social and economic consequences are likely to follow from the decline of the nation's numerical growth to a point of negligible gain. This country has become accustomed to a continually increasing population and consequently has the viewpoint and habits of an expanding nation. When it comes to the end of its population growth, however, the elasticity provided by a constantly increasing population and the expansion in markets consequent thereto will disappear.

Business men must gradually readjust their programs of production to meet the changing demands of a shifting age distribution. They will also be compelled to regulate production in conformity with any effect resulting from the slackening rate of increase in population during the next generation. This may be difficult because industrial and merchandising men have grown up and have operated for the most part in an atmosphere of rapid expansion. However, it is entirely possible that the slackening rate of increase of consumers may be offset by the broadening demand for goods, especially if the decline in population growth is accompanied by a tendency for the standard of living to improve. While expenditures for necessities may not greatly change, expenditures for cultural progress should increase considerably.

The time when the population will reach a point of virtual stabilization is of the utmost importance to agriculture, particularly with reference to the future need for farm land, since the number of people which constitute the domestic market very largely influences the consumption of farm commodities, especially food products for which the demand is relatively inelastic. The slower growth of population is also practically certain to affect the constantly increasing intensiveness of the use of land for residential and business purposes in and about our large cities.

Summary

The birth rate in the United States has been declining very rapidly and is now only two-thirds as high as it was twenty years ago. In fact, the birth rate is hardly sufficient to maintain permanently a population as large as at present, although the great number of young adults who will not die for many years, the heritage of a higher birth rate and heavier immigration in the past, will result in a slow increase in population for perhaps 20 to 25 years more.

The tendency of the past twenty years toward lower birth rates has decreased the proportion of children and has increased the average age of the population. This tendency toward an increase of older and a decrease of younger persons will become more marked with each decade. In fact, it is characteristic of a slowly growing population to have relatively few children but many old people.

The conclusion cannot be avoided that voluntary control in one form or another is the major factor in the rapid decline in the birth rate. One or two children per family, apparently, is considered enough by many parents, particularly those living in cities. But it is estimated that approximately three births per mother are required to maintain even a stationary population, as many children die in infancy, and a few more die before reaching marriageable age, while about 15 per cent of the adults never marry.

Furthermore, in view of the established facts that urban birth rates are lower than rural rates, that foreign-born white women are more fertile than the native-born, and that birth rates of women 20 to 29 years of age are higher than of those at older ages, it follows as a logical consequence that the increase in the proportion of persons living under urban conditions and the decrease in the proportion of married women 15 to 45 years of age who are foreign-born or who are 20 to 29 has contributed materially to the sizeable decline in the national birth rate during recent years.

Accompanying this drop in the birth rate has been a very gradual decline in the death rate, due largely to a marked reduction in infant mortality. But it is expected that, due to the advancing average age of the population, the death rate will slowly increase for a number of years until either the present bulge in the age distribution disappears or the span of life increases materially.

The advancing average age of the people and the increasing

proportion of the native-white stock in the total population should contribute rather heavily to a broader and better market for goods and services, and these developments might conceivably more than offset the declining numerical growth. Moreover, since a larger proportion of future urban gains will come from rural sources than in the past, due to greatly reduced foreign immigration and the fact that the native-white urban population is not replacing itself, there should develop a wider range and variety of common interests between the cities and the country and consequently there should arise an even greater need for intercommunication.

R. L. TOMBLEN

Notes on Recent Occurrences

"A FUGUE IN CYCLES AND BELS"

TO be connected with the telephone industry implies to most people a considerable familiarity with the technique of transmission. For those telephone people who aspire to talk—and think—intelligently on what their art is doing for and to the older art of music, a new volume by John Mills, "A Fugue in Cycles and Bels" (D. Van Nostrand Co., New York), offers both instruction and entertainment. Mr. Mills, who is Director of Publication of Bell Telephone Laboratories, has seen the frontiers of speech move westward from Denver to San Francisco, then eastward to Paris and London, and step by step onward until the globe has been encircled. During the same twenty years, that other frontier—telephonic quality—has been advanced until the music of a full orchestra can be transmitted with entire fidelity. It is the latter field which he surveys in his recent book.

At the end of Mr. Mills' lively account of Pythagoras, Galileo, Mersenne and Helmholtz, one feels that he has some acquaintance with the relationship between pitch and frequency. By easy steps, Chapter 2 takes the reader through elementary notions of the ear, the voice, complex vibrations and the telephone transmitter. Subsequent chapters deal with scales of pitch and loudness, with amplifiers, microphones, loud speakers and with the Laboratories' researches in audition. Other chapters on the power of music, on noise, on overloading and distortion and on auditorium acoustics lead up to the achievement of the reproduction of music in auditory perspective and what that feat, performed two years ago, may mean to music of the future.

Mr. Mills has wisely grouped all tables and graphs at the end

of the volume. This section forms a useful compendium of information on frequencies, decibels, response curves, energy levels and the like.

The engineer will find "A Fugue in Cycles and Bels" easy to read and a source of data not always available. The musician who aspires to be something more than an instrumentalist cannot afford to neglect an acquaintance with the physical bases of his art which this book will give.